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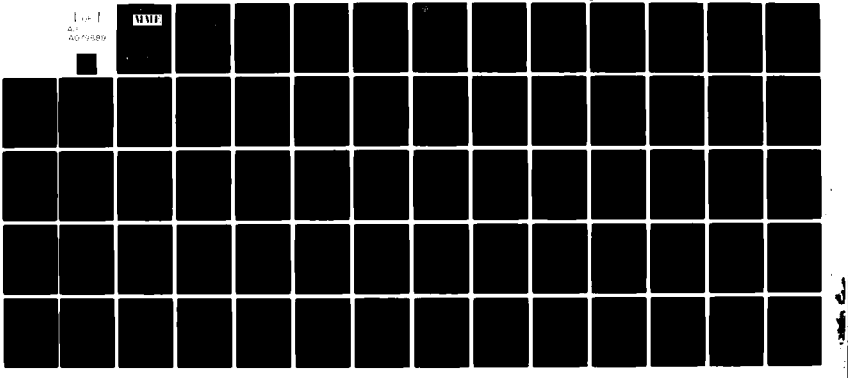

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MME

MILITARY MESSAGE EXPERIMENT

Mid Experiment Report

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November 16, 1979

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) MME — Security kernel AMH — SIGMA Message system — COTCO Security — DISTAN	
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The Military Message Experiment (MME) is designed to evaluate the utility of user-oriented message processing systems in a military environment and to aid in determining the features useful in such a system. The experiment is a cooperative effort between the Commander-in-Chief, Pacific, the Navy, and the Defense Advanced Research Projects Agency. To conduct the experiment, a PDP-10-based system has been installed at CINCPAC Headquarters for use by a portion of the Operations Directorate. The message processing functionality is provided by SIGMA, a program (Continues)	

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20. Abstract (Continued)

written by the Information Sciences Institute of the University of Southern California. It is supported by the TENEX operating system, and the user terminals are modified HP-2649A CRTs. A final report, to be published in April 1980, is planned.

The MME system is designed to give the user the capability to handle his message traffic (both incoming and outgoing, formal and informal) on the system. The system enforces multilevel security rules based on a modification of the security kernel model developed at Mitre. The rule enforcement is not rigorous enough for certification, but it is sufficiently rigorous to determine the effects on the users' interactions with the system. Most of the functions needed for a user's message-related tasks are provided by the system: message distribution and redistribution, "electronic readboard" construction, message filing, message replies, message commenting and "chopping," and message release.

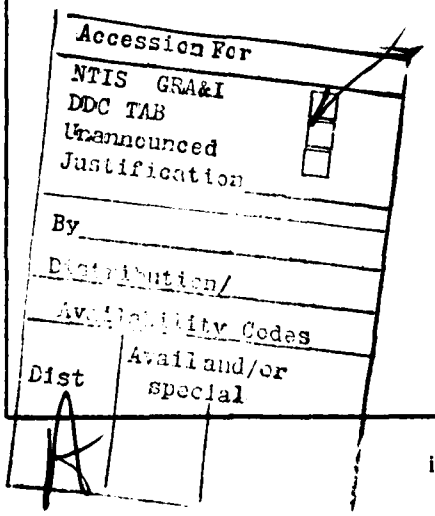
Based on the limited amount of time the system has been in use, the following tentative conclusions have been drawn:

a. An Automated Message Handling System is useful in a military environment.

b. An Automated Message Handling System must be an integral component of a communications system whose overall design carefully considers the ways in which the users will interact with the system. The total system must be reliable; it must provide services to everyone involved with message handling in the user environment; it must provide a proper balance between ephemeral displays and paper copies.

c. An Automated Message Handling System, with a carefully designed user interface, can provide a useful subset of functions that can be made available to the casual user without the need for extensive formal training.

The objectives of the experiment are being met. Many of the answers that are needed by designers of future Automated Message Handling Systems will be provided before the conclusion of the experiment. Multi-level security is one of the important research issues that is being addressed during the experiment. A section of the final report will be devoted to a description of the security model used, the system design issues that it raised, and the effect it had on the users' interactions with the MME system.



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To: Distribution List

Subj: Military Message Experiment (MME) Mid-Experiment Report

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2. Enclosure (1) is the second of three Military Message Experiment reports to be issued and covers the period from November 1978 through March 1979. The third and final report will be issued during April 1980.

G. B. SHICK, JR

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2 November 1979

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Subj: Military Message Experiment (MME) Mid-Experiment Report

Ref: (a) MME Memorandum of Agreement September 1978

Encl: (1) MME Mid-Experiment Report

1. In accordance with reference (a), the subject report is submitted as enclosure (1). The report covers the period of the Experiment from November 1978 to March 1979 and includes the last three months of Limited Experimental Use (LEU), the first month of Full Experimental Use (FEU), and the Command Post Exercise POWER PLAY 79. Preliminary Conclusions are provided in Section 6, while CINCPAC's User Perceptions are included as Appendix A.

2. Additional copies of this report may be requested from Code 7503, Naval Research Laboratory, Washington, D.C. 20375.

Roger L. Reasonover, Jr.

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CONTENTS

MILITARY MESSAGE EXPERIMENT
MID EXPERIMENT REPORT

SECTION 1

EXECUTIVE SUMMARY

This report is the second of three reports to be prepared during the Military Message Experiment (MME); the first report [reference 1] was published April 30, 1979, and describes the initial portion of the experiment from May 1977 to November 1978. In addition, it describes the objectives of the experiment and the system being used to conduct the experiment. This report covers the period from November 1978 through March 1979.

The Military Message Experiment is an effort to evaluate the utility of computer-aided message handling in a military environment and to aid in the determination of the type of automation needed in message processing within military environments such as that at CINCPAC. In order to establish a framework for the experiment, a Memorandum of Agreement [reference 2] was signed by the Director of the Defense Advanced Research Projects Agency; the Commander, Naval Telecommunications Command; the Commander, Naval Electronic Systems Command; and the Commander-in-Chief, Pacific, in December 1975 and revised in September 1978.

Briefly, the experiment consists of (a) the installation of an Automated Message Handling System that links a selected portion of the CINCPAC staff to the AUTODIN communications system, (b) on-site support and training, and (c) an evaluation team made up of personnel from CINCPAC, NRL, NAVSEA, NAVELEX, MITRE, and CTEC. The automated message handling is provided by the MME system consisting of the SIGMA message processing program (written by the Information Sciences Institute of the University of Southern California) operating under the Bolt, Beranek, and Newman-developed TENEX operating system on a PDP-10 computer (KL processor and one million words of memory). Modified Hewlett-Packard HP-2649A CRTs are used as terminals.

The initial system was installed in May 1977. A period of shakedown, training, and hardware and software improvements followed, and the J3 staff began limited experimental use (LEU) of the system in July 1978 with SIGMA version 2.0. The following are significant milestones from the start of limited experimental use through the period covered by this report.

Limited Experimental Use	Jul 1978
SIGMA Release 2.1	Sep 1978
Hardware upgrade (KL processor, 1M words memory)	Oct 1978

Note: Manuscript submitted August 7, 1979.

SIGMA Release 2.2	Jan 1979
Full Experimental Use	Feb 1979
Exercise Power Play 79	Mar 1979

Training of the users continued through the limited experimental use phase, and the system responsiveness and functionality were upgraded by new hardware and by software releases 2.1 and 2.2. The system was also used to process incoming traffic during this period.

Full experimental use of the system began in February 1979 and continued through the time covered by this report. The system was used to create, coordinate, and transmit some of the J3 staff's outgoing traffic and to construct readboards containing annotated messages for the J3 staff.

In March, participants in Exercise Power Play 79 used the system as a secondary message handling device, operating in parallel with the current paper system. Routine administrative use of the system was continued during the exercise. No significant difference was noted in the style of use from that found in day-to-day operations, with the exception that the outgoing capabilities of the system were used more heavily by the exercise participants. During the period of the exercise, however, some problems with the software and with the procedures for using the system in an exercise were discovered. A replay of the exercise has been scheduled so that the use of automated message aids during a crisis can be better evaluated.

During the time covered by this report there have been some periods in which the system has been very unreliable, and these periods of unreliability have had an effect on the user's view of the system. In December, a number of problems were encountered with the disk memory subsystem. The disk drive and the backup disk controller were down for an extended period and user files were damaged. The overall system availability for December was 86.8% compared with 98.4% and 97.4% for October and November. The disk problems continued intermittently through February. In early March, a malfunctioning filter on the main power line was removed. This, along with corrective measures to the electromechanical portions of the disk subsystem, restored the MME system stability. The system availability increased from 92.9% in January and 83% in February to 96.8% in March. A new disk subsystem was installed in April; its use started in the period immediately after that covered by this report. The new disk is more reliable and doubles the amount of available storage.

In general, the level of use of the system has increased for all types of users. There was a peak during the exercise, and the data indicate that the amount of use of the system after the exercise was beginning to stabilize.

A number of problems have been identified in the MME system's interface to the AUTODIN via the LDMX. While some of these problems have provided useful information to the designers of future automated message handling systems,

others have prevented the examination of some aspects of message handling during the experiment. In particular:

1. Because of current LDMX operating procedures and software design, TOP SECRET messages cannot be delivered to the MME system.

2. If a message is not originally distributed to J3 by the LDMX, the LDMX will not subsequently deliver the message to the MME system even if requested to do so by personnel from another directorate.

3. Some AUTODIN format checks are done in the MME system; some are done in the LDMX. The MME, on occasion, has transmitted an improperly formatted message that caused the LDMX system to crash. In addition, a message that has been transmitted to the LDMX by the MME system can no longer be edited in the MME system even though it was rejected by the LDMX.

4. There are incompatibilities in the handling of m tisection messages and readdressals by the two systems.

No one of these problems is disastrous, but they indicate the need for the integrated design of the total communications system. In addition to the obvious problems that are listed, there are subtle differences in the handling of messges in the MME and the rest of the communications system that cause the user annoyance (e.g., the maintenance of the plain language address directory and the lack of rigorous format control throughout all of the communications system for subject line, references, pass-to instructions, and keywords).

User observations and opinions were collected by using a detailed questionnaire completed by both daily and exercise users and by conducting interviews with senior J3 personnel. The users encountered many problems with the lack of reliability and responsiveness of the system. But even with these problems, the users believe that many of the AMH system features are valuable and assigned an overall positive rating to the system. Their recommendations for the development of an AMH system emphasize that the problems with the MME system (such as slow response and an inadequate number of terminals) must be corrected in future systems. They also emphasize the need for an integrated design of the total message handling system. The results of the questionnaire and the interviews, the documented user concerns and requests for changes, and the observations of the on-site evaluation team have been used in forming the following set of tentative conclusions. These conclusions are discussed in greater detail in section 6 of this report.

The following are conclusions concerning the MME system rather than the concept of Automated Message Handling Systems.

> Conclusion 1. The lack of reliability of the MME system has been a major complaint of the CINCPAC staff users and has had an impact on their perception of the MME system in particular and automated message handling in general.

Conclusion 2. Despite system problems, the users appear to prefer the MME system to the manual message-handling system. The users were asked to indicate their preference for automated or manual message handling in each of three general categories: receiving messages, filing and retrieving messages, and creating and sending messages. (See Appendix A for a more detailed analysis.) The daily users indicated a slight preference for automated message handling for receiving messages and a distinct preference for automated message handling for filing, retrieving, creating, and sending messages. Within the general category of receiving messages, the users indicated a distinct preference for the manual system for the initial review of incoming messages. The exercise users indicated a slight preference for the manual system for receiving messages, a distinct preference for the automated system for message filing and retrieval, and a slight preference for the automated system for creating and sending messages.

The following are preliminary conclusions concerning the concept of User-Oriented Automated Message Handling Systems.

Conclusion 3. An Automated Message Handling System is useful in a military environment.

Conclusion 4. An Automated Message Handling System must be an integral component of a communications system whose overall design carefully considers the ways in which the users will interact with the system. The total system must be reliable; it must provide services to everyone involved with message handling in the user environment; it must provide a proper balance between ephemeral displays and paper copies.

Conclusion 5. An Automated Message Handling System, with a carefully designed user interface, can provide a useful subset of functions that can be made available to the casual user without the need for extensive formal training.

The objectives of the experiment are being met. Many of the answers that are needed by designers of future Automated Message Handling Systems will be provided before the conclusion of the experiment. The use of a system such as the MME in an exercise or crisis is discussed in this report; the exercise will be rerun and the results reported in the final report. The type of use that such a system gets is discussed in this report and will be expanded in the final. Interviews will be conducted and further analysis of the data will be done to make a better estimate of the response time needed by users in a message handling system. Multi-level security is one of the important research issues that is being addressed during the experiment. A section of the final report will be devoted to a description of the security model used, the system design issues that it raised, and the effect it had on the users' interactions with the MME system.

SECTION 2

INTRODUCTION

This report is the second of three reports to be prepared dur' ıg the military message experiment (MME); the first report [reference 1] was published April 30, 1979 and describes the initial portion of the experiment from May 1977 to November 1978. In addition, it describes the objectives of the experiment and the system being used to conduct the experiment. This report covers the period from November 1978 through March 1979.

Briefly, the experiment consists of (a) the installation of an Automated Message Handling System that links a selected portion of the CINCPAC staff to the AUTODIN communications system, (b) on-site support and training, and (c) an evaluation team made up of personnel from CINCPAC, NRL, NAVSEA, NAVELEX, MITRE, and CTEC.

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The initial system was installed in May 1977. There was a period of shakedown, training, and hardware and software improvements. The J3 staff began limited experimental use (LEU) of the system in July 1978 with SIGMA version 2.0. The following are the significant milestones from the start of limited experimental use through the period covered by this report.

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SIGMA Release 2.1	Sep 1978
Hardware upgrade (KL processor, 1M words memory)	Oct 1978
SIGMA Release 2.2	Jan 1979
Full Experimental Use	Feb 1979
Exercise Power Play 79	Mar 1979

Sigma Release 2.1 upgraded the responsiveness of the system. Release 2.2 had changes to increase performance and to provide additional functionality; it had an improved facility for alerting users when a high-precedence message arrives and an improved facility for coordinating outgoing messages. At the end of March, there were 20 terminals installed in user spaces. In designing the experiment, many factors were weighed in determining the number of staff officers to participate in the experiment and the number and distribution of terminals. The plan to use a total of 25 terminals recognized that the number

was too small and that, ideally, terminals should be placed so that each staff officer involved with messages would have easy access to a terminal. Given the experiment limitations, the ideal distribution of terminals was not possible.

During the time covered by this report there have been some periods in which the system has been very unreliable, and these periods of unreliability have had an effect on the user's view of the system. In December, a number of problems were encountered with the disk memory subsystem. The disk drive and the backup disk controller were down for an extended period, and user files were damaged. The overall system availability for December was 86.8% compared with 98.4% and 97.4% for October and November. The disk problems continued intermittently through February. In early March, a malfunctioning filter on the main power line was removed. This, along with corrective measures to the electromechanical portions of the disk subsystem, restored the MME system stability. The system availability increased from 92.9% in January and 83% in February to 96.8% in March. A new disk subsystem was installed in April; its use started in the period immediately after that covered by this report. The new disk is more reliable and doubles the amount of available storage.

The remainder of this report discusses the use of the MME System from November 1978 through March 1979. The observations and conclusions in this report are based on statistics collected and analyzed on-site and statistics that were automatically collected, written on tape, and shipped to Mitre, Bedford, for analysis. In some cases, the periods of data collection differ for the on-site and for the Mitre-analyzed statistics. For most of the statistical summaries, the time covered by this report (16 October 1978 - 7 April 1979) has been divided into 26 periods. Except for periods 1 and 14, these are all 7-day periods. In addition, the users have been assigned to groups according to functional position and amount of use; the groups are defined in section 3.

Section 3 describes the use of the MME system by the staff officers during their normal duty periods. Section 4 describes the use of the MME system in a Command Post Exercise. Section 5 describes the problems encountered in interfacing the MME system to AUTODIN, and Section 6 presents the conclusions reached so far in the experiment. Appendix A presents the observations of the CINCPAC users, and Appendix B contains data tables describing the use of the system.

SECTION 3

PATTERNS OF USE

The total number of users on the system and the number of new users introduced each week from 16 October 1978 to 7 April 1979 are presented in Appendix B, Table 1. The total number of users increased from 26 on 25 October to 89 on 17 March and then appeared to reach a steady state of 70 on 7 April. The maximum number of new users per week was 10 in early January followed by 8 in early November and, again, in early March. The peak use occurred during Exercise Power Play 79. In Figure 1, two metrics are plotted to indicate the general pattern of system use - the solid line indicates the number of users per day on the system and the broken line indicates the average daily peak instructions per hour for each of the periods. There was a period of system instability in the early part of January that is reflected in the lower amount of use. The number of instructions per hour statistic was not collected between 10 January and 21 February. The system use increases with the beginning of the full experimental use phase and peaks during the exercise Power Play 79. The data indicate that the system use is stabilizing after the exercise, but the period of observation isn't long enough to draw that conclusion.

A comparison of the session transcripts for the beginning, middle, and end of the reporting period reveals that there is a consistent core of experienced users. In the week of 19 October, 26 users logged on the system; in the next week (26 October), 23 of these same users were seen on the system. Seven new users logged on. The pattern of a few new users being added each week to a consistent core of users continued throughout the period.

During the period of November 1978 to April 1979, the average number of MME sessions per week per user did not change significantly (it was around six sessions per week). The average length of a session did increase (from around 1.5 hours to 2 hours) as did the number of instructions per job. Hence these metrics also indicate increasing system use during the period.

In the remainder of this section, the data that were collected during the limited and full experimental use phases are discussed. The limited experimental use (LEU) period examined is 2 November 1978 through 10 January 1979 (a ten-week period); full experimental use (FEU) of the MME system began 22 February 1979, and data for this report were collected through 7 April 1979 (a little more than a six-week period).

Patterns of use among different types of users are of interest because they illustrate the relationship between the type of job a person has and the amount and type of resources needed to support that job. To facilitate the analysis of the relationship between system use and job position, Sigma users have been divided into groups according to their functional positions. The groups are:

Division/Branch Administrative (DBADM) - clerical personnel with administrative responsibility.

J301 - the administrative section of J3.

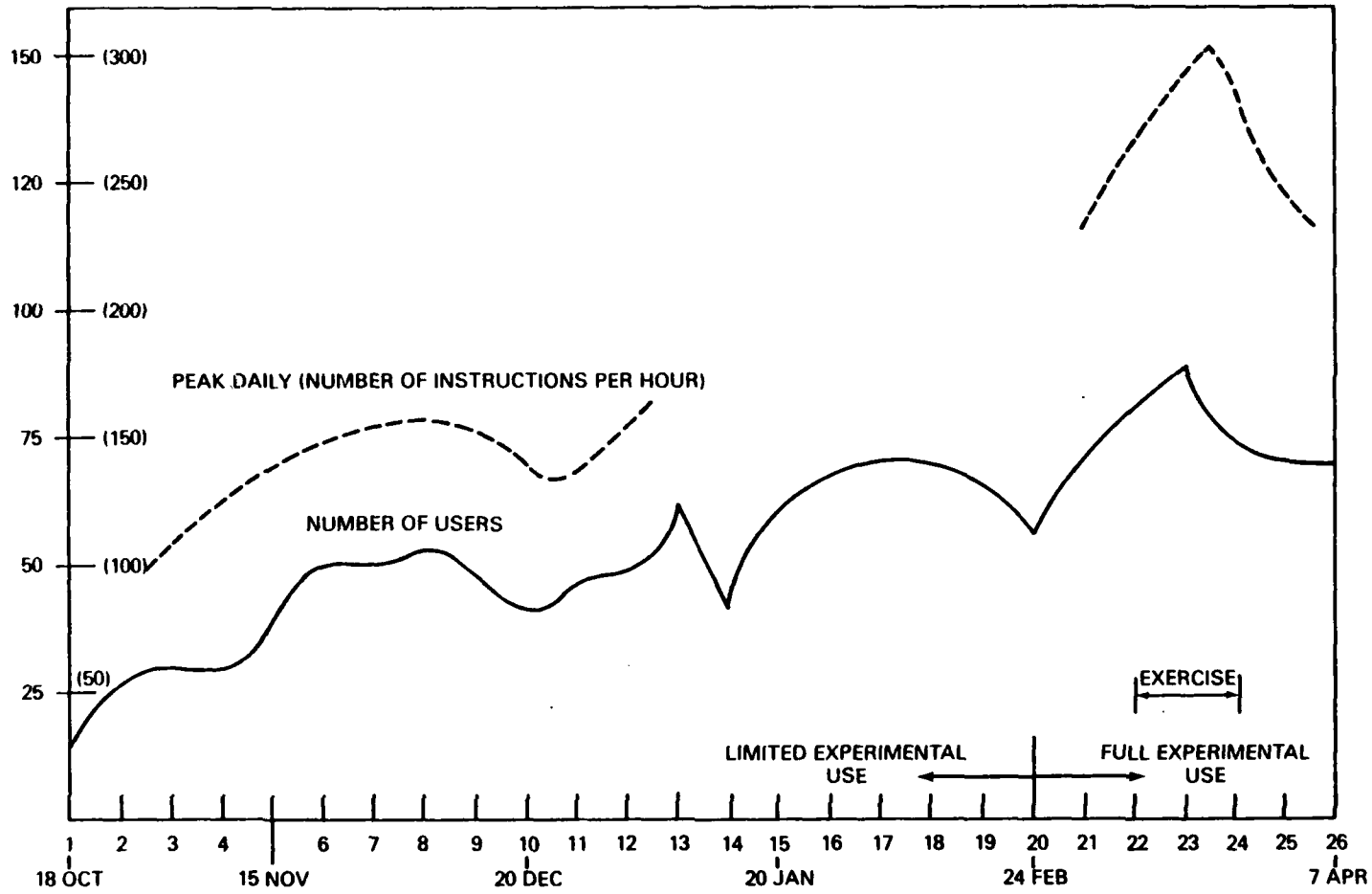


Fig. 1 - System use

Action Officers (DBACT) - action officers are further divided into categories depending on the volume of messages handled.

Division/Branch Management (DBMGT) - management personnel in the division and branch offices.

Division/Branch Clerical (DBCL) - clerical personnel with clerical responsibility (as compared with DBADM)

Duty Director of Operations (DDO) - head of the command center watch team.

Air and Surface Desk Officers (AIR/SUR) - on command center watch team.

Joint Reconnaissance Center (JRC) - officers in the JRC.

3.1 AMOUNT OF USE

Understanding the type of load put onto a system by different types of users is important for designers of future systems. For some types, such as J301 and the Command Center Watch Team, a fairly small number of people per shift have a specific set of message-related tasks to perform. Examination of session transcripts and patterns of use data show that these types of users developed consistent daily habits when using Sigma. To determine the resources needed to support these users, the group activity should be analyzed.

For other types of users, the load put on the system by the individual is more important. In the division and branch offices, and among the action officers, the tasks to be performed have more day-to-day variation. System use is related to the individual office message load and the events of the day. To support these offices it is necessary to look at the office, the message load, and the number of people in the office.

The different approaches needed to determine necessary support for different user types have led to the presentation of the data in two forms. One shows the average amount of Sigma use by the entire group of users in a given type; the other shows the average amount of use by an individual user of a given type. Table 10 of Appendix B shows in detail the amount of on-line time and the number of instructions executed for the different types of users by group and by individual during each LEU and FEU period.

3.1.1 ON-LINE TIME

The amount of time a user spends logged on has been found to be related to terminal placement as well as to job function. In areas such as the Command Center and division and branch offices, terminals are designated for primary use by a particular position. These users are generally logged on throughout the bulk of their work shifts, even though they may not use the system continuously. In areas where a terminal is shared by many users, each user's on-line time is less; the users log on, use the system, but then often have to turn the terminal over to another user. (An exception to this pattern is

found in J301, where the users have a terminal for their primary use, but tend to log on, distribute the messages and log off when the task is complete.) In many cases, long log-on times and low usage indicate that the user is keeping the terminal on in case of message alerts, as in the Command Center, or so that he can respond quickly to a request for information, as in the division offices.

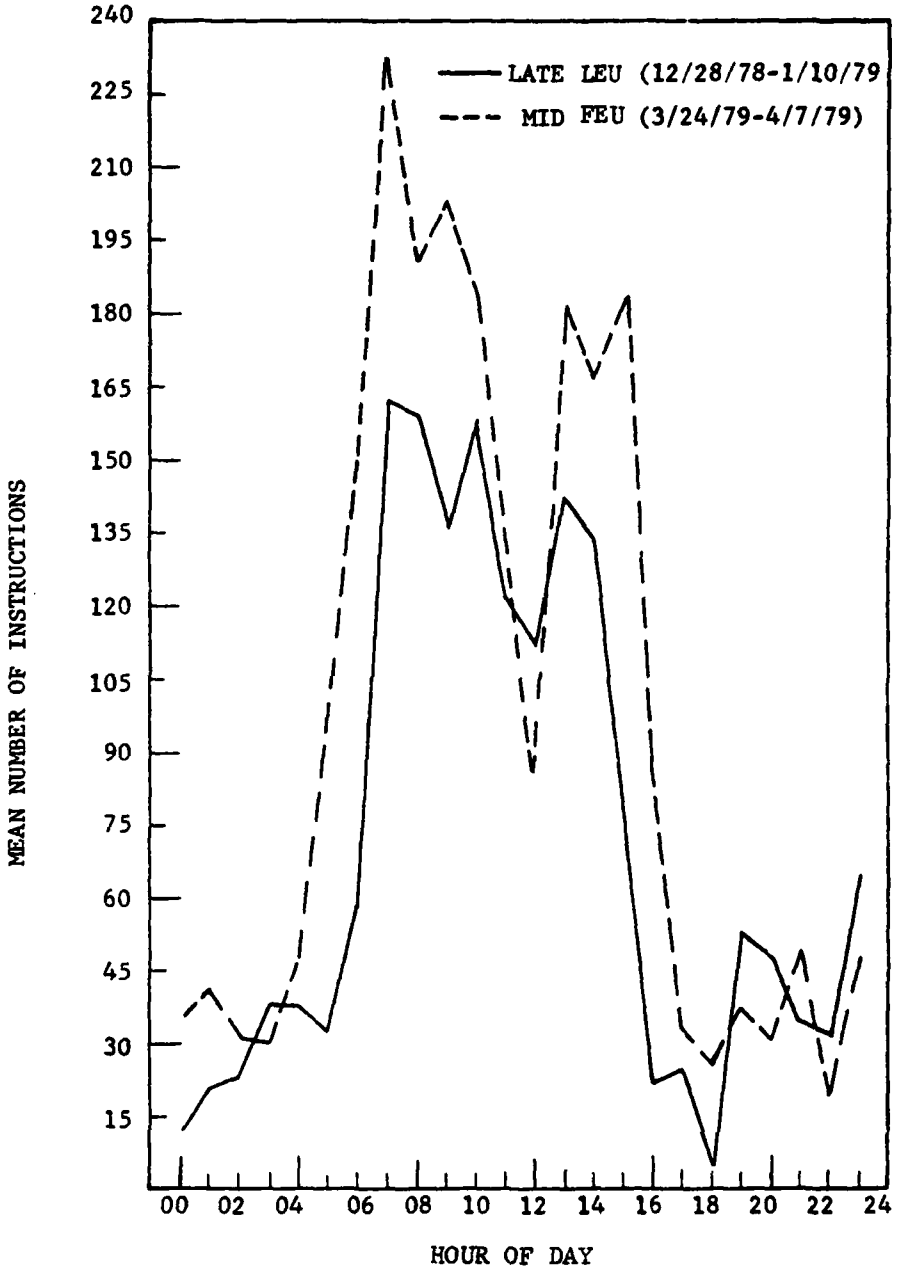
In determining distribution of terminals for the future, several factors must be considered. These are the importance to the user of having a terminal readily available when asked for information, the importance of his receiving an alert as soon as it arrives, and the importance of his accomplishing a task in a given amount of time or at a particular time of day. The greater the user's dependence on terminal availability for accomplishing an essential task, the more important it is for the user to have a terminal dedicated to his use.

3.1.2 SYSTEM USE

The transition from LEU to FEU did result in generally longer on-line times; however, it is necessary to look at the number of instructions executed to see if the system was, in fact, receiving more use.

Figure 2 shows a comparison of the mean number of instructions executed per hour at the end of LEU and at the end of the FEU period covered in this report. With the exception of the noon hour, the mean number of instructions increased during the regular work day. (During the off-hours the system is used primarily by the Command Center and JRC personnel. Individual differences among this small group of users (four per shift) is the most likely explanation of the variation shown during off-hours in both periods.) The increased use is due partly to a greater number of users on the system and partly to a greater amount of use by the core group already familiar with Sigma.

Directives for system use issued at the beginning of FEU had the greatest effect on J301, the Command Center duty officers, and administrative personnel in the division offices. J301 was directed to distribute early in the day the messages that had accumulated overnight; they were also directed to continue message distribution throughout the day. The greatest increases in MME system use were in the Air and Surface desk duty officers' activities. The Air Desk duty officers were directed to create readboards for the J3. (These readboards were also available for use by other offices within J3.) The Surface desk officers responded to the FEU directives by processing messages on-line whenever possible. The use of the MME readboards by division chiefs was evident in an increased level of activity by their administrative personnel, who use both their own accounts and those of the management personnel (DBMGT). The support personnel responded to requests from their chiefs to find information, including readboard items, for them.



Mean Number of Instructions per Hour

3.2 TYPE OF USE

One of the goals of the MME is to determine what capabilities are necessary in an automated message handling system (AMHS) and to whom. It is important once again to look at differences in the styles of use of different types of CINCPAC users. Their job responsibilities influence the instructions they execute on Sigma and the sequence of actions they perform.

3.2.1 FUNCTION UTILITY

The value of the many message-handling functions Sigma offers varies considerably. Some functions are used by nearly everyone. Others are used heavily by one type of user but are ignored by the rest. Other instructions are seldom used, but are critical to an important task. Other instructions appear to have no value (at best, marginal value) for any users. A goal of the data analysis is to identify into which of these categories each of the Sigma functions falls.

The LEU and FEU data show that many Sigma instructions are executed by all types of users, rather than being used particularly by any one group. For example, "restrict" and "augment", which enable a user to select a subset of messages, received a moderate amount of use by all types of users during LEU and FEU. These instructions and similar functions can be considered to be generally useful for future systems.

Relatively few of the instructions are used heavily by only one type of user. Route is an example of such an instruction. This instruction performs four functions on a message or group of messages. It assigns action on them, forwards them for information, files them in designated files, and deletes them from the pending file if designated to do so. Route is used almost exclusively by J301 (the section responsible for message distribution within J3). Route represents 25-30% of all instructions executed by J301. During the FEU period reported here (about six and a half weeks), J301 users executed the route instruction 2603 times. Without route they would have executed four to ten times as many instructions (and would have taken more time) to perform the same tasks. This confirms that the utility of a function must be evaluated in terms of its utility to each group of users rather than only in terms of overall use by the entire set of users.

Finally, there are instructions that are seldom used, but are critical to a particular task. "Release message" is such an instruction. The small number of outgoing messages sent via Sigma resulted in light use of release by the limited set of personnel given release authority. Regardless of the amount of use it received, however, release is necessary in a system designed to support outgoing message processing.

By the end of the experiment it will be possible to categorize instructions and functions by their relative utility to the different types of users and to the overall group of users. Some instructions may turn out to be of marginal use to everyone. These would have low priority in the design of future systems.

3.2.2 STYLES OF USE

Analyses of session transcripts and interviews with the users have shown that there is a relationship between a user's style of interaction with the system and his position in the organization.

In J301, a typical session begins with the user displaying his pending file, a file containing citations for all the incoming messages. (Each citation contains information about a message: originator, date and time of transmission, precedence, classification, and subject.) He first identifies (through the use of previously stored selectors) so-called "junk" messages which do not have to be distributed, and deletes them. Using standard selectors, he then identifies various sets of messages with common routing criteria (a common subject, for example). Each of these message sets is distributed using an appropriate routing object. After all the messages satisfying the standard selectors have been distributed, the user checks the remaining messages and distributes them.

Most of the messages are distributed on the basis of the information contained in the citations; during FEU, only about 7% of the messages distributed were viewed before the distribution decision was made. J301 chooses to view messages, rather than displaying them, because viewing does not disrupt the list of message citations in the display window. This type of use clearly indicates the need for split- (or dual-) screen display.

The Air desk officers have a similar style of system use, based on their responsibility for creating readboard files. First, sets of selectors are used to find various types of messages appropriate for each of the readboard files. (This is analogous to using standard selectors to find messages with common routing criteria.) After each set is selected, the user files those messages in the appropriate readboard file and deletes them from his pending file. When all the pre-defined sets have been found, the user scrolls through the remaining message citations one at a time, deleting each citation as it is scanned. The officers choose to delete these messages individually, rather than as a group, to ensure that all have been seen. As a result, the Air desk officers execute a high proportion of delete message instructions.

Other types of users have less structured tasks to perform. While an individual member of one of these types, action officers or clerks for example, may develop consistent habits from day to day, as a group, these types have more variation in their system use than J301 and the Air desk duty officers. One action officer may use Sigma only for reading, printing, and deleting messages, while another might take advantage of selectors and other file and message manipulation functions.

There are several points of interest regarding all types of users. The choice of "display" or "view" to look at a message is primarily a matter of personal preference; the two instructions are used almost equally. Some users choose to view messages, which enables them to keep a list of the message citations in the "display window" (the upper portion of the CRT) at the same time. This list can be manipulated while a message is being viewed. Other users choose to display messages and rarely view them. A need to edit the

message and the brighter intensity of the display window are factors influencing this choice. It is clear from the amount of use that both display and view receive that both are useful capabilities. A split screen option, and the ability to look at a message, text object, or file list in one window without losing the ability to manipulate an object in the other window, are capabilities that should be included in future system designs.

It is also apparent from the relatively low number of messages displayed and viewed, in comparison to the number delivered to their pending files, that the users are making many decisions about the disposition of their messages on the basis of the message citation. Because paper copies of the messages are being distributed in parallel with Sigma distribution, this point will be probed further during the final interviews. At present it is not clear if the users recognize the messages from having previously seen the paper versions, or if the citation does contain sufficient information for their decision making. (In J301 recognition is not a factor; these users have already stated that the citation contains sufficient information to permit direct distribution of 93% of the messages.)

3.2.3 FLAGGED INSTRUCTIONS

Instruction flags are artifacts of the data collection facility. They are recorded in the data collection files when a user tries to execute an instruction that cannot be completed successfully. They may indicate an error on the part of the user, or they may indicate the system's inability to complete (from a system viewpoint) a legitimate instruction.

The greatest number of flags occur when the user, processing a set of messages after having already processed the last message, tries to execute an instruction to process the next message in the set. When this happens the system returns a "you are currently at the end of the file" message. While this does not distress the users, who have become accustomed to interpreting it as an "end of list message", it does cause some delay. A better design would be to provide an end of list indicator when the last item of a list is being processed.

Another common flag occurs when the user tries to process an open object and none is open. Evidently users lose track of the status of various types of objects even though an indication is provided in the status line at the top of the screen. This point will be investigated further in the final interviews.

Two types of flags occur frequently because of system status. One is the failure to display a file or message because that object is being updated or because a message has been archived. The other is the failure of a restrict or augment instruction to result in entries that satisfy the specified parameters. In the former case, the unavailability of an object due to update status or previous archival forces the user to decide if seeing the object is worth the delay. In the latter case, the appearance of the message "your selector returned no entries" is regarded by the users as a satisfactory system response; it requires no further action by the user. In both cases, as far as the user is concerned, the system has responded to his instruction; no errors have been made.

SECTION 4

EXERCISE PARTICIPATION

The MME system was used during the JCS Exercise Power Play 79. The main objectives of the MME participation were to develop procedures for the use of an automated message handling system in exercise/crisis situations and to determine the usefulness of such a system in exercises and crises.

4.1 BACKGROUND

This exercise was a 24-hour per day Command Post Exercise (CPX) conducted from 6 to 23 March 1979. A CPX is an exercise involving the Commander, his staff, and communications within and between headquarters. CINCPAC participation in the exercise was minimal; there was a skeleton Operations Action Group (OAG), but there was no Operations Planning Group and no Logistics Readiness Center.

The Staff's basic approach to a crisis is to form crisis action teams comprised of a Crisis Action Coordinator, a Deputy Crisis Action Coordinator, a Current Operations Support Element, an Operations Action Group, an Operations Planning Group, and a Logistics Readiness Center. The Operations Action Group is composed of the Deputy Crisis Action Coordinator, the Operations Action Group Executive Officer, and representives from staff directorates. It functions as a coordination point for unifying the efforts of the Operations Planning Group, Command Center Watch Team, Current Operations Support Element, Logistics Readiness Center, and significant support actions. The Operations Action Group is located in the CINCPAC Command Center. For additional description of the OAG see pages 35 and 36 in appendix A.

4.2 PRE-EXERCISE SET-UP AND TRAINING

Fifty MME accounts were identified and established. These included the Crisis Action Coordinator, Deputy Crisis Action Coordinator, Chief of the Operations Action Group, Executive Officer, Assistant Executive Officer, J1 (personnel), J2 (Intelligence), J3 (Operations), J4 (Logistics), J5 (Plans), J6 (Communications and Data Processing), J74 (Public Affairs), Exercise Controller, Operations Action Group, Logistics Readiness Center, and Current Operations Support Element. The exercise accounts were opened as one group (i.e., each account was able to access all files, text objects, and selectors in the other accounts). All accounts were opened with release authority for informal notes. The Deputy Crisis Action Coordinator and the Chief of the Operations Action Group had release authority for formal memoranda and AUTODIN messages.

Personnel from the CINCPAC directorates J1, J2, J3, J4, J5, J6, and J74, and from IPAC (Intelligence Center Pacific) who were potential Operations Action Group members were identified together with their message-handling tasks. These personnel were trained to use the MME system with emphasis on

the tasks they were expected to perform during the exercise. The training began 1 February 1979 and continued throughout the month of February. It consisted of a one-hour introductory lecture to groups of users, with three hours a day available for hands-on training and experience. Both officers and administrative personnel were trained.

4.3 MME PARTICIPATION

Prior to and during the first week of the exercise, the procedures for the use of the MME system during the exercise were determined and implemented. The effort included determining and establishing the files, text objects, and selectors required by the MME Executive Officer for effective use of the MME system during the exercise. The remaining members of the exercise team were free to establish their own objects on an individual basis.

The MME system was used as a secondary message-processing system on a non-interference basis. The MME participation commenced at the beginning of the exercise and continued throughout the exercise.

The MME Executive Officer duplicated the functions of the regular Executive Officer, who utilized the paper message-handling system. The MME system was used for message distribution, retrieval, coordination, and release. The initial plan called for directorate Action Officers, as time permitted, to duplicate on the MME their paper-system actions. When it was established that the MME system was in a stable operating condition, they were encouraged to and did use the MME system as their primary system for certain outgoing messages, e.g., those with a 24-hour or longer suspense time.

To support their exercise functions, the MME Executive Officers created and maintained 15 files, 36 text objects, and 2 selectors. The 15 files included a master file for all messages received by the Operations Action Group, a Status-of-Action Log (SAL), a Significant Events Log (SEL), and various files for situation reports, JCS Action messages, Operations Action Group action requests to the JCS or other Headquarters, CINCPAC directives to subordinate headquarters, MME transmitted messages, paper-system transmitted messages, readdressals, backcopies, etc.

The 36 text objects were used mostly to ROUTE incoming messages to different combinations of the exercise accounts for Action and/or Info, FILE in the Master file, and DELETE from the Executive Officer Pending file.

The two selectors were the ALERT_SELECTOR that selected and alerted the MME Executive Officer on all incoming messages that were FLASHOVERRIDE or FLASH or IMMEDIATE or FOR_RELEASE or FOR_CHOP or ACTION, and a selector used to screen files for NOTEs.

The following paragraph describes the message handling procudures used by the MME Executive Officer (MXO), the Deputy Crisis Action Coordinator (DCAC), and the Action Officer (AO).

All incoming messages on the MME came to the OAG Pending File (OAG MXO). The MXO reviewed each incoming message citation (or message, if necessary). If there were an OAG action required, he assigned action on the message to the appropriate OAG action officer (AO) which automatically updated the SAL. If the message were action on a COG item, he forwarded it to the appropriate OAG AO. All incoming messages were filed in the OAG Master file. Important messages were forwarded to the DCAC. The MXO maintained and updated the SEL as required. The MXO reviewed all outgoing messages, ensured all chops had been made, resolved any non-concurrences, and forwarded the messages to the DCAC for release. If the outgoing message satisfied a pending OAG action, the MXO updated the SAL. If the outgoing message directed a subordinate to act or requested action from a co-lateral or higher headquarters, the MXO posted the appropriate files. All outgoing OAG messages were filed from the OAG Pending File to one of the three outgoing files. The MXO ensured that all actions generated from non-message sources were entered into the SAL and SEL as appropriate. The MXO readdressed messages as directed by the DCAC. A terminal was available for the DCAC, but was rarely used. Releasing outgoing messages, especially readdressals, was the DCAC's primary use of the system. The AOs had two terminals available for their exclusive use, in addition to being able to use the DCAC's terminal most of the time. Many AOs made extensive use of the MME system during the time available to them when they were not processing actions using the manual system. The J2 and J4 AOs created extensive files to support the wide variety of messages received during the exercise.

A summary of activity, system availability, and traffic handled during the exercise is given in Appendix B, Table 8.

Normal administrative use of the system continued throughout the exercise. In order to make the system more responsive to the exercise users, the scheduling algorithm was changed to give the exercise users higher priority than the other users. Even so, there was a noticeable degradation in system response time during the period 0600-0900 on normal work days.

A CINCPAC SITREP was required, on a 24-hour basis, throughout the exercise. The one-time development of the SITREP on the system demonstrated the utility of interactive capabilities within the system. The different directorates prepared their portions according to a fixed form and forwarded them to the MME Executive Officer who assembled them, prepared the message, and forwarded the message to the DCAC for release.

4.3.1 PERSONNEL

The personnel actually assigned to the exercise team were not those previously identified and trained. Thus, the personnel reporting at the commencement of the exercise had to be trained by the MME Executive Officers and the MME Observer. Those personnel reporting later were trained mostly by the initial members of the exercise team with assistance from the MME Executive Officers and Observer. In spite of the lack of previous exposure to the MME system, they quickly learned to use the MME in carrying out many of their specific duties. For this exercise, the Operations Action Group was activated with the Deputy Crisis Action Coordinator, Executive Officer, MME Executive Officer, and Action Officers from the J2, J3, J4, J5 and J6 directorates.

4.3.2 HIGHLIGHTS

Even though there was an excessive amount of system downtime, the MME system, when available, was able to process and distribute messages in a timely manner. The readdressal feature was enthusiastically received by the Operations Action Group Action Officers and, once demonstrated, was used for almost all message readdressals. During periods of low Operations Action Group activity, some outgoing messages were created and released on the MME system. On one occasion, the CINCPAC SITREP was prepared on various Action Officer terminals, assembled by the MME Executive Officer on his terminal and released by the Deputy Crisis Action Coordinator on his terminal. The ability to retrieve messages from files was the system feature for which the users expressed the highest degree of preference.

4.3.3 PROBLEMS

The major problem with the use of the MME system was the unacceptable amount of unscheduled system downtime. The lack of system reliability mandates a backup or redundant message-handling system. Initially a very high load average caused by a software failure resulted in lengthy delays in executing commands. Delays also occurred during the coordination or release process. On one occasion, it took over an hour for a message to get from one OAG terminal through the processing cycle and arrive at another Operations Action Group terminal.

The non-J3 members of the Operations Action Group were inexperienced in the use of the MME system and the terminal. Although a training program had been established in January 1979 specifically for non-J3 Operations Action Group members, most of the non-J3 members who actually participated in the exercise were not fully qualified on the system. This was overcome by intensive on the job training. Within a few sessions the non-J3 Operations Action Group members were capable of using the system to display, file, retrieve, create, and comment on messsges with minimal assistance.

The release of OAG-originated and readdressed messages was hampered by previously unknown interface problems between Sigma and the LDMX. A related problem was the lack of notification to the user when a message was rejected by the LDMX.

The MXO, who was fully trained and experienced on the MME system, was totally occupied in trying to accomplish all the tasks he was supposed to perform during the periods he was working on the MME system. Some of these tasks were not ones that would need to be accomplished in the normal prosecution of an exercise, but were tasks designed to aid in the evaluation of the MME during this particular exercise. At times he was not able to keep up with every task and had to postpone some, such as maintaining the SAL or other files containing suspense items. The MXO was able to catch up with incoming message distribution in approximately one hour after being absent for an extended period (up to 8-10 hours), due to the low message arrival rate. Since there were relatively few outgoing messages processed on the MME system, the MXO did not spend much time on this facet of message handling. The MXO did spend some time assisting the other OAG users. This would not be required if

all OAG members were fully trained. The MXOs agreed that one MXO per 12-hour shift would not have been able to handle all the tasks assigned to the MXO for Power Play 79 if the incoming message flow had been comparable to that of Exercise Nifty Nugget - given the problems that existed with the MME system during the exercise.* But, providing that the system's reliability and responsiveness can be improved, the MME system should be of great assistance to the MXOs in several of their message-handling tasks. The MME system's speed and filing system permit much more efficient maintenance of the master message file and log, the SAL, and the SEL.

The highlights and problems associated with the use of the MME system in PP-79 are covered in greater detail in Appendix A.

4.4 MME SYSTEM EFFECTIVENESS

A user's perception of the effectiveness of a system is based on whether or not it helps him do his job better or easier. This is influenced by what he sees as the objective of the exercise, by the type of training he has received, by the system's reliability and availability, and by the system's capability and efficiency.

A batch-processing system may be down a few hours without a user realizing it; he may simply get his messages a bit later. Users are acutely aware of all the reliability/availability problems of an interactive system that they are using and depending on. The reliability requirements for an automated message handling system in a crisis or exercise are very high.

There were three factors that prevented this exercise from serving as a satisfactory test for determining the usefulness of an automated message processing system in an exercise/crisis situation. First, CINCPAC participation in the exercise was minimal; second, the MME system was used as the secondary message-processing system on a non-interference basis; third, there were periods during the exercise when a software problem caused excessive system delay.

Timing statistics were recorded during one period of the exercise in order to compare the message arrival times for copies of messages sent directly and copies sent via the MME system.

Upon receipt of a high-precedence message for the Operations Action Group, the LDMX routes it to the MME system and directly to a printer in the Operations Action Group spaces. Lower precedence messages and back-up copies of high precedence messages are sent from the Communications Center via a pneumatic tube. For the 37 messages that were received during the period, the average arrival time via the MME was 3.4 minutes later than the arrival time on the line printer. The arrival time of the back-up copies and the lower precedence messages via the tube was 2 to 29 minutes later than the arrival via the MME.

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*Exercise Nifty Nugget was conducted late in calendar year 1978. The traffic load was substantially higher than that in Power Play 79.

SECTION 5

INTERFACE TO AUTODIN

The designers of future automated message handling systems must be sensitive to the problems that arise because of the lack of an integrated design for the total communications system. In the military message experiment, some of the features that the users see are provided by the MME system and some, e.g., plain language address translations, transmissions to the AUTODIN network, and initial distribution to the J3 Directorate, are provided by the Local Digital Message Exchange (LDMX). Although there are recognized inefficiencies in the MME hardware and software, there are strong indications that the type of service provided to users by the MME/LDMX combination will require more computer power (in processor cycles and memory) than was previously estimated. And while it is realized that in future systems different architectures for distributing the computing power will be used, there will be a need to perform in an integrated manner (from the user's view) those functions that are now performed by the MME system and by the LDMX. The observations during this phase of the MME lead to the conclusion that there must be an integrated design for the total communications system.

The LDMX was developed by the Navy under its automation program. The procedures and software in the LDMX are used at many Navy communications facilities, and any changes are closely controlled by COMNAVTELCOM to ensure the integrity of the system. Because of this, changes to the LDMX take a long time to be approved and implemented (as they should in an operational system), and, thus, most of the changes to correct problems in the LDMX/MME interface are made in the MME system. Because some of the problems cannot be solved in just the MME system, they remain outstanding. Some of the problems that must be considered by the designers of future systems are discussed in Section 5.2.

5.1 SUMMARY OF AUTODIN TRAFFIC

5.1.1 INCOMING MESSAGES

During the period 16 October to 7 April, the MME System processed a total of 113,597 AUTODIN messages. As can be seen by the message traffic, (see Table 4, Appendix B) the weekly average increased from approximately 3,000 messages per week to just over 5,000 messages per week. A peak of 8,000 messages was reached during the week of 11-17 March during the exercise. The percentage of J3 Action/Cognizance messages ranged from 30-50%. The main contributing factor to both the increase of average messages received and the lowering of the J3 Action/Cog percentages was the reintroduction of Foreign Broadcast Information Service (FBIS) type messages on the system. This was done in late November.

5.1.2 OUTGOING MESSAGES

General use of the MME system to transmit messages was authorized to begin on 22 February 1979. At that time, the system was operating with general service traffic up to the SECRET level. Some constraints were placed on the initial use of the MME system to transmit messages. The MME system was used

to prepare and transmit an out-going message if a) the message's classification was no greater than SECRET, b) there were at least two working days prior to the message's suspense date, c) all items referenced by the message were on the MME system, and d) all coordinating officers were MME system users. From that date to 7 April 1979, 228 outgoing AUTODIN messages were created and released by J3 users on the MME system. In general, about 40% of the messages released on the system were original narrative and 60% were readdressals of incoming messages. In comparison, it appears that about 45% of all J3 outgoing message traffic are readdressals. Message creation and release peaked during the exercise. Two weeks after the exercise (25-31 March), 38% of J3's outgoing traffic was created and released on the MME system.

The messages released on the MME System during the period of observation tended to be shorter than the average messages released by the J3 Directorate. Use of the system for release tends to follow the typical day-of-the-week pattern seen in the world of paper messages.

5.2 MME/LDMX INTERFACE

The use of the MME system for outgoing traffic starting in late February 1979 and intensifying during the exercise participation in March revealed a number of incompatibilities in the MME/CINCPAC LDMX interface. These incompatibilities caused problems that vary in seriousness. Some could require manual intervention by LDMX personnel and result in delayed delivery; others could result in non-delivery of messages.

5.2.1 INCOMING MESSAGES

This section discusses the handling of special categories of messages such as TOP SECRET and Limited Distribution messages and the general forced delivery of messages to the MME System. Because of current LDMX operating procedures and software design, it is not possible to deliver TOP SECRET messages to the MME system.

Frequently, a member of the CINCPAC Staff will determine that J3 should receive a copy of an incoming message on which J3 was not included in the initial distribution. In such a case, the staff member submits to the LDMX a "request for a change in internal distribution" in which he adds J3 and any other office codes that he feels are appropriate. The LDMX recalls the message and performs a "distribution edit." When the edit function is executed, the LDMX can provide delivery of the message only to a printer. The LDMX cannot cause delivery of the message to the MME system. This results in "missing messages" in the MME data base; i.e., J3 users receive some messages via the paper system that are not received from the MME system. A method to force delivery of the message to the MME system in this case is necessary.

5.2.2 OUTGOING MESSAGES

The LDMX requires that outgoing AUTODIN messages adhere to a prescribed format. There have been numerous occasions when the MME system sent outgoing AUTODIN messages to the LDMX in improper format; some resulted in LDMX crashes. The major format problems have been corrected.

5.2.3 RETRANSMITTALS

When the LDMX has rejected a message sent to it by the MME system, it is no longer editable in the MME system nor can it be released again. Currently, it is not possible to retransmit a released message from the MME system to the LDMX without creating an entirely new message and repeating the release process. The MME system should provide the capability for the MME operator and/or the users to correct and retransmit released messages that were rejected by the LDMX.

5.2.4 MULTISECTION MESSAGES

The LDMX does not pass the sections of incoming multisection messages to the MME system consecutively in order. The MME system, in turn, is unable to recognize the sections of multisection messages; consequently, incoming multisection messages may appear in the MME files out-of-order and interspersed among other messages.

In the case of outgoing messages (paper and MME systems), the LDMX sectionalizes long messages, assigning the same DTG to all sections of the message. For readdressals in the paper system, a separate Form DD173 is submitted for each section of the readdressed message, the LDMX recognizes the various sections of the readdressal, and it assigns the same DTG to each section of the outgoing message. However, SIGMA assigns a unique DTG to each outgoing message it forwards to the LDMX. SIGMA has no capability to recognize multisection readdressals and, therefore, does not assign the same DTG to each section of a multisection message. The LDMX, in turn, recognizes an inconsistency in this situation and rejects the readdressal with a Service Message to the MME system.

5.2.5 READDRESSALS

Whenever the size of the LDMX on-line data base reaches a prescribed number of pages, they archive. In LDMX jargon, this is called a database wrap-around. Currently, wrap-around involves messages that have been on-line for 15 days or more. When an MME user initiates a request to readdress one of these archived messages, the LDMX rejects it with a Service Message to the MME. This may cause a non-delivery of the message being readdressed.

5.2.6 UNCLASSIFIED-EFTO MESSAGES

CINCPAC users frequently need to originate Unclassified Encrypted for Transmission Only (UNCLAS EFTO) messages. Currently, SIGMA permits the user to create an UNCLAS message and to then edit the classification line (in format line twelve of the message) to read UNCLAS EFTO. However, SIGMA does not change the classification indicators in format lines two and four. Because of the classification mismatch between format lines two, four, and twelve, the LDMX rejects the message and sends a Service Message citing the security mismatch. This deficiency results in manual intervention, unnecessarily-delayed delivery, and potential non-delivery of the message.

5.2.7 SERVICE MESSAGES

When the LDMX receives a message which it cannot process, it returns an abbreviated message called a Service Message. This Service Message identifies the message in question and states the reason for nonprocessing. The appropriate addressee for the Service Message must be determined. In some cases, it is appropriate for the LDMX to handle them; in other cases the MME system or message drafter needs to be consulted. Currently, the MME system contains no provisions for handling Service Messages. This results in a potential non-delivery of outgoing messages released by the MME system.

5.2.8 LACK OF UPWARD COMPATIBILITY IN LDMX RELEASES

NAVCOMPARS software version 9.0 is scheduled for installation in the CINCPAC LDMX. As a result of this change, the LDMX will lose the capability to recall and retransmit messages by Channel Sequence Number (CSN). This feature has a tremendous amount of utility in the LDMX/MME interface and its use is referred to as a Channel Rerun Request (CRR). In order to ensure the integrity of the MME message data base, the MME operator routinely scans the Channel-Log in search of missing CSNs. The missing CSNs are then passed by telephone to the LDMX Command VDT operator as a CRR command, and the messages are retransmitted to the MME system. Without this feature, there is no assurance that a message from the LDMX to the MME has not been lost.

5.2.9 MESSAGE FORMATS

Currently, there is no jointly agreed-upon rigorous format control for subject line, references, key-words, and pass-to instructions. A message that is passed to the MME system from the LDMX contains the distribution information that the LDMX has generated and that portion of the received message that is defined in ACP-126. Thus, the text field contains, in addition to the text, information that is needed for intra-Directorate distribution. In order that future message processing systems be able to automate many of the functions that are now done manually, ACP-126 should be modified to add discipline to the handling of pass-to instructions, references, keywords, and subject.

5.2.10 DUPLICATIVE UNCOORDINATED CONTROL CHECKS

Most of the problems encountered in the LDMX/MME system interface are the results of data stored redundantly and checks made independently in the two systems. This results in a system that presents sometimes confusing and contradictory responses to the user. These problems have lead to Conclusion 4, that an Automated Message Handling System must be an integral component of a communications system whose overall design carefully considers the ways in which the users will interact with the system. The total system must be reliable; it must provide services to everyone involved with message handling in the user environment; it must provide a proper balance between ephemeral displays and paper copies.

SECTION 6

CONCLUSIONS

The Military Message Experiment is an effort to evaluate the utility of computer-aided message handling in a military environment and to determine the type of automation necessary. The Memorandum of Agreement [reference 2] assigns the responsibility for evaluating the experiment to the Navy. Thus the inputs from the user (CINCPAC) and the developer (DARPA) are used by the evaluator (Navy) in evaluating the concept of automated message handling. The user's evaluation of the system is included in Appendix A. It was one of several sources used in developing the conclusions in this section. Other sources include on-site observations, analysis of user-requested changes, interviews with users, and analysis of data automatically collected by the system.

A conscious effort has been made to distinguish the conclusions that are applicable only to the experimental vehicle (the MME system) from those that are applicable to the concept of automated message handling. Further, because of the formal and informal training that has been given to the users, some of the system use during the time reported on may have been in response to that training. For instance, a set of proficiency milestones was devised by the J3 staff and used to classify the proficiency of users. There is no way to determine from the statistics recorded whether the system at any particular point in time was being used for proficiency training or to accomplish useful work. Thus, it may be inappropriate at this point in the experiment to conclude that the most-used MME functions are the most important functions for a future message processing system. But there are certain conclusions that can be made based on the statistics and observations of the users.

The following are conclusions concerning the MME system rather than the concept of Automated Message Handling Systems.

> Conclusion 1. The lack of reliability of the MME system has been a major complaint of the CINCPAC staff users and has had an impact on their perception of the MME system in particular and automated message handling in general.

Based on the questionnaires completed by the MME system users and on interviews conducted with fifteen J3 division and branch chiefs, the users generally like the concept of an Automated Message Handling System and the MME system itself. The major complaints are the lack of reliability, the insufficient number of terminals, and the slowness of the MME system for reading and reviewing messages. These complaints were factors in reaching some of the more-general conclusions concerning future message handling systems.

Conclusion 2. Despite system problems, the users appear to prefer the MME system to the manual message-handling system. The users were asked to indicate their preference for automated or manual message handling in each of three general categories: receiving messages, filing and retrieving messages, and creating and sending messages. (See Appendix A for a more detailed analysis.) The daily users indicated a slight preference for automated message handling for receiving messages and a distinct preference for automated message handling for filing, retrieving, creating, and sending messages. Within the general category of receiving messages, the users indicated a distinct preference for the manual system for the initial review of incoming messages. The exercise users indicated a slight preference for the manual system for receiving messages, a distinct preference for the automated system for message filing and retrieval, and a slight preference for the automated system for creating and sending messages.

The "most-liked" features are those that are used in releasing messages, editing messages, replying to received messages, creating messages, and retrieving messages. The most-frequent complaint concerning reviewing incoming messages on the MME system is that, although the messages are received earlier on the MME system, it is much slower than the manual system for actually reading or scanning the message text. A comparison of the message delivery times in the automated and manual systems will be included in the final report.

The goals of the MME include evaluating the utility and the cost-effectiveness of automated message handling systems. The features and performance of the vehicle (the MME system) used to conduct the experiment are important in the determination of useful features for future systems. In response to the interviews and questionnaires, the users have been very helpful in detailing those problems in the MME system that need to be improved before deployment of automated message handling systems. (See Appendix A.) In writing this report, the evaluators have taken care to separate those comments that apply only to the experimental vehicle from those that apply to the AMHS concept. Most of the problem areas described in this report pertain to the MME system and its physical environment (including power and communications links), not to the AMHS concept. Further, the cost used in the cost-effectiveness evaluation must be based not on the MME system cost, but on the cost of the technology that will be used to build AMHSs in the mid-to-late 1980s.

The following are preliminary conclusions concerning the concept of User-Oriented Automated Message Handling Systems.

Conclusion 3. An Automated Message Handling System is useful in a military environment.

The principal goal of the Military Message Experiment is to determine the utility of an Automated Message Handling System in a military staff

environment. The prelimiary conclusion is that such a system is, in fact, useful in that environment.

A reliable, responsive automated message handling system provides message delivery to users much faster than the manual system. A system that properly integrates the MME and the LDMX functions with the proper mix of ephemeral and hard-copy displays can make message delivery and distribution faster and more accurate. An AMHS that provides a coordination and release function that allows users to interface with other staff members either by paper or terminal can speed up message coordinations while maintaining a log of the procedure. During a crisis, a command staff is inundated with problems that must be solved quickly. An AMHS can aid the staff by providing rapid and accurate message filing and retrieval and aids in preparing immediate responses.

Another goal of the experiment is to develop a set of metrics so that the usefulness of an AMHS can be measured in terms of the Staff's function. Such measures of effectiveness (MOE), if a valid set can be developed, would provide a basis for making better decisions in the allocation of developmental resources. The effort to develop the measures of effectiveness is continuing. Data are being collected in an attempt to measure delivery and handling times, but the ultimate value of speed and efficiency are extremely situation-dependent. The final conclusions and recommendations on this issue ultimately must be based on analysis of both the quantitative data in conjunction with the subjective reactions of the users.

> Conclusion 4. An Automated Message Handling System must be an integral component of a communications system whose overall design carefully considers the ways in which the users will interact with the system. The total system must be reliable; it must provide services to everyone involved with message handling in the user environment; it must provide a proper balance between ephemeral displays and paper copies.

An MME-type system will be only one component of the future communications system that serves users such as those participating in this experiment. The MME system was designed to provide users with additional message-handling features, and it was designed to be a compatible component within an existing communications system. Even so, one of the more frustrating problems for the MME system users has been the lack of compatibility of the MME system and the rest of the communications system. The problems are cited in the user's evaluation in appendix A, and the particular problems in the MME-LDMX interface are described in section 5.

Thus, one of the MME's important lessons for future system designers is that an integrated design for the total communications system is necessary to ensure user satisfaction. The MME evaluators believe that separate design and development responsibilities for user-oriented message processing systems and telecommunications center message processing systems can lead to serious component compatibility problems such as those that exist between the MME system and the LDMX.

Users demand that an interactive system that they depend on to accomplish their daily tasks and to resolve problems in a crisis must be very reliable. Although they may not notice downtime in a system that they access via paper (such as the LDMX), they are acutely aware of the downtime in a system that is accessed via a terminal in their office. In order for an AMHS to be reliable from the user's perception, its software must be thoroughly tested and debugged, the hardware must be reliable and redundant, and the system must be housed in a non-hostile environment. The experiment has demonstrated that unreliable power can have a disastrous effect on system reliability.

The need to provide services to everyone does not necessarily mean that everyone involved with message processing must have a terminal; the system may recognize that some users are serviced by hard-copy output and by a central terminal for input. But the system must have well thought-out procedures for including those users in message distribution, coordination, and release. There are some tasks that users can do more efficiently with paper copies of messages. There are other tasks where, even if there is no gain in efficiency, a user feels more comfortable with paper copies. It will be crucial in future AMHSs to provide an adequate number of displays, an adequate number of printers strategically located, and an adequate system plan for providing user services via paper copies.

> Conclusion 5. An Automated Message Handling System, with a carefully designed user interface, can provide a useful subset of functions that can be made available to the casual user without the need for extensive formal training.

For those who will be heavy users of an AMHS, there should be formal training so that they interface with the system in an efficient manner. Because of the normal turnover in a military staff, there will always be new users of a system. The user interface should be designed to accommodate these new users and casual users in a friendly manner.

SECTION 7

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SECTION 8

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APPENDIX A. CINCPAC USER EVALUATION OF THE SYSTEM

I. INTRODUCTION

A. Objective.

The primary objective of the MME, as defined in the MOA, is "to determine the utility of an interactive message service in a major military headquarters." One of CINCPAC's responsibilities under the MOA is to participate in this evaluation. The objective of this appendix is to summarize the users' observations and evaluations of the installed equipment and software and, on that basis, to identify features of an interactive message service which, even at this early stage, are clearly necessary, and to identify deficiencies in the current system which impede achievement of the primary objective of the program.

B. Outline and Summary.

Sections II and III of this Appendix describe how the MME was used and what the users' observations were during daily operations and during a Command Post Exercise (CPX), respectively. These observations were collected by means of a detailed questionnaire completed by 23 daily users and 15 CPX participants, supported by interviews with the Deputy J3, a Duty Director for Operations, all four participating division chiefs, and eight of their branch chiefs. Although the users believe that many features of an Automated Message Handling System (AMHS) would be valuable, as indicated by positive overall ratings, they encountered many problems with the lack of reliability, scope, and responsiveness of this particular implementation. Section IV states the current conclusions of the CINCPAC staff relative to the objective of the experiment. In summary, potential manpower savings and the operational utility of an AMHS have yet to be demonstrated, primarily because of the problems met in using the MME. Section V presents some preliminary recommendations for the development of AMHSs, emphasizing the need to correct the MME problems and achieve interoperability and compatibility with other message-handling systems.

II. USE IN DAILY OPERATIONS

A. Usage.

1. Starting on 22 February 79, with the beginning of Full Experimental Use, the Operations Directorate attempted to use the MME as their primary message-handling system. Participants were expected to use the MME to handle incoming messages (read or review the messages, comment on them or on the related file entries, and assign action and forward messages to other users), to file and retrieve messages, and to prepare outgoing messages and memoranda (create the message or memo, coordinate with other staff offices, edit the in-preparation message or memo, and release it).

2. During the period 22 February-7 April 1979, preparation of messages and memos was purposely limited because the system had not demonstrated that it could meet the requirements for full operational use in a dynamic environment. Its initial use was confined to those actions which met the following criteria.

(a) The security classification of the message or memo did not exceed that of the MME system.

(b) There were at least two days of working time available to meet the assigned suspense date.

(c) All items referenced by the message or memo were in the MME system's data base.

(d) All offices with which coordination was required were on the system.

3. From the onset of MME operations, only ACTION/COG messages have been distributed from the Directorate's Administrative Branch (J301) to the participating divisions. Participants who need other messages have access to a file containing all messages received by the Operations Directorate. In an attempt to evaluate a more discrete message distribution system, one division (J34) established a selector that allowed it to receive an approximation of its normal distribution. This resulted in the receipt of more messages than normal because the selector was necessarily broad to avoid missing any messages of interest. Wider use of similar selectors by other divisions was not practical because of the additional administrative burden it would have placed on J301.

4. The creation of Division and Branch files was left to the discretion of the participants. After the start of FEU, it became apparent that most of the files created were personal files for individuals. In an attempt to evaluate the use of an organizational filing system, J34 created Division and Branch files for its action officers.

B. User Observations.

1. During this period, the MME system had a significant amount of unscheduled downtime and abnormal terminations. This was the most serious drawback to its use. The users evaluated system availability, discounting scheduled downtime, as unsatisfactory, with a score of 48 on a rating scale of 0-100. All 23 users responded.

2. The users were asked to compare the MME system to the manual system in each of 12 message handling tasks. The score of 100 shows absolute preference for the MME system, and 0 shows absolute preference for the manual system. The parenthetical entries group the tasks into the three major message-handling categories and show weighted averages of the results. The use factor indicates the percent of users who used the MME system for that particular task.

TASK/CATEGORY	PREFERENCE	USE FACTOR (%)
Reviewing Incoming Messages	34	91
Commenting on Incoming Messages	58	43
Assigning Action	61	48
Passing Messages to Others	71	74
(Incoming Messages)	(54)	
Filing Messages	64	83
Maintaining Files	65	83
Retrieving Messages	75	96
(Filing/Retrieval)	(68)	
Creating Messages	78	83
Replying to Messages	77	74
Coordinating In-prep Messages	74	65
Editing In-prep Messages	77	78
Releasing messages	79	65
(Outgoing Messages)	(77)	

3. Users evaluated the responsiveness of the MME system for the same 12 message-handling tasks, using the rating system described in paragraph B.2. The differences between the Use Factors shown in this table and those shown in the table above result from inconsistent responses by a few of the respondents.

TASK/CATEGORY	SATISFACTION	USE FACTOR (%)
Reviewing Incoming Messages	60	100
Commenting on Incoming Messages	64	57
Assigning Action	70	48
Passing Messages to Others	79	70
(Incoming Messages)	(67)	
Filing Messages	79	91
Maintaining Files	75	87
Retrieving Messages	76	100
(Filing/Retrieval)	(76)	
Creating Messages	81	96
Replying to Messages	81	65
Coordingating Messages	74	57
Editing In-Prep Messages	71	70
Releasing Messages	71	52
(Outgoing Messages	(76)	

4. Users' comments on the utility of the MME in performing the 12 message-handling tasks are summarized below.

(a) Incoming messages. Handling incoming messages received a preference rating of 54 and a responsiveness rating of 67 [indicating a slight preference for the use of the MME system and a stronger preference for the responsiveness of the MME system over the manual system], but most user comments were negative.

(1) Reviewing incoming messages on the MME system is too time consuming. The file citations in many cases do not show enough information to determine whether or not to call up and read the message. To be certain, the message in question must be viewed or displayed, which takes much more time per message than with the manual system. The scrolling process can be very slow, especially with a high load average. Most users said they can scan a paper message much more quickly than a message on the MME screen, and that they can go back and forth on a paper message much more rapidly than on the MME image. Having to scroll through a long list of addressees prior to reaching the message text also wastes time. The inability of the MME system to group multi-sectioned messages is a drawback. The relatively small number of terminals allows only one person at a time in each branch to look at incoming messages on the MME system. Some users found the message review process better on the MME system because they could look at all the incoming messages to J3 (within the limits of the security constraints) rather than getting only the selected messages delivered to them by the manual system.

(2) Annotating incoming messages using the MME system is awkward, slow, and limited compared to the paper system. Moreover, the comments can't always be positioned where the user really wants them. On the paper copy, it is much easier to make a note in the margin, or to underline or highlight portions of the text. However, comments made on the MME system stand out very distinctly.

(3) Assigning action on a message is easier in the manual system by stamping or writing "Act - Jxxx" on the paper copy. Because of this ease and the additional administrative burden of operating two suspense systems, the assignment of actions below the directorate level was not exercised. Not having all of J3 on the MME system limits the benefits of this MME system function.

(4) The forwarding capability of the MME system is potentially very useful. Electronic transmission of messages is much faster than in the manual system. Again, not having all of J3 or any other directorate on the MME system limits the usefulness of this feature. Moreover, if the recipient is not at his terminal, the advantage of the transmission speed is lost.

(5) The system caused a shift in some administrative responsibilities to the action officers. With the message distribution system used, the individual action officers had to "pull" messages from the daily message file instead of having messages of interest "pushed" to them by administrative personnel.

(6) J34 and its branches (J341 and J342) created a set of files that are used for processing incoming message traffic as it is received from J301. Each morning the Branch Chiefs review the J34 pending file, delete non-germane messages, and use the remaining messages to brief the Division Chief on items of immediate interest prior to his daily meeting with the J3. The deficiencies noted in paragraphs (1) and (2) above severely limit the usefulness of the MME system in this process. When the Division Chief has completed his message review, the Branch Chiefs route the remaining messages to various files for review by the action officers. The J34 users found that

by the time the messages had been routed all the way to the branch files and the users had been able to get access to the one available terminal, they could have already seen the messages in the paper system and started any required actions.

(b) Message filing and retrieval. The users found the MME system better for message filing and retrieval. The following advantages and disadvantages of the MME system were cited.

(1) Most users found message filing in personal files much faster and handier on the MME system.

(2) Branch and division files were not generated as a result of daily operational use. The files created specifically for evaluation purpose, as noted in paragraph A.4 above, were not used, primarily because action officers who had carefully maintained their paper files could retrieve a message faster from them. An important secondary reason was the unavailability of files because of system unreliability.

(3) In some special applications, maintaining files on the MME system is handier and faster than on the manual system. Common-user files are easier to maintain manually. The slowness of message review makes selective purging of MME files too time consuming.

(4) Retrieval of messages from MME files was found to be a very valuable capability for messages which the user had not kept in well-organized paper files. The ability of the MME system to retrieve messages on arguments other than DTG and on multiple arguments allowed flexibility in the search for messages which could not be identified definitively. It was also beneficial in retrieving complete categories of messages. The principal complaint about message retrieval was the length of time required to get messages from the archives. Also, if the exact DTG of a message is not known, a search must be made through several datefiles in order to retrieve the message by other arguments (subject, originator, etc).

(c) Outgoing messages. Although processing of outgoing messages received a preference rating of 77 and a responsiveness rating of 76, the tenor of the user comments was negative.

(1) A lack of terminal availability hampered use of the MME system in offices with large numbers of outgoing messages and memos. The MME system tends to turn action officers into clerk/typists, with the requirement to learn message formats, administrative procedures, etc.

(2) The coordination cycle was poor because it was cumbersome to use and did not model the real-world process well. Unless all coordinators were alerted and were awaiting the arrival of a message or memo for chop, the coordination cycle normally took longer on the MME system than manually. Users said that face-to-face coordination on many messages, especially those that raise a controversial issue, is much more effective. Coordination was also hampered because sometimes not all references for an action are on the system.

(3) Users found that editing or commenting on in-preparation messages or memos is just as easy in the manual system as in the MME system, especially if the typist has a word-processing facility.

(4) Users foresee an excellent potential for the release of messages by the MME system into the AUTODIN system, but problems in the Sigma-Local Digital Message Exchange (LDMX) interface [see Section 5 of this report] have caused a reluctance to trust the MME system. Users were unanimous in their enthusiasm for the MME system's readdressal capability. Distribution of memos to participating J3 divisions was done on a regular basis without any system problems. External distribution caused awkward control and routing problems at the electronic/manual interface.

III. EXERCISE USE.

A. General.

1. The MME system was used to support the CINCPAC Operations Action Group during Exercise Power Play 79 (PP-79), a JCS world-wide CPX conducted 6-23 March 1979. This section discusses the composition and functions of the Operations Action Group, the manner in which the MME system was used to support it, the highlights and problems encountered, and observations of the MME system's usefulness in supporting Operations Action Group message-handling tasks.

B. OAG Composition and Functions.

1. The OAG is a small staff element formed to support the CINCPAC Crisis Action Coordinator during a crisis or exercise. It handles all crisis or exercise matters requiring immediate attention, including handling of incoming and outgoing message traffic.

2. The OAG normally consists of the Deputy Crisis Action Coordinator (DCAC), Chief of the OAG (COAG), Executive Officer (XO), Assistant Executive Officer (AXO), and an action officer from each of the CINCPAC staff sections (J1, J2, J3, J4, J5, J6, and J74 (Public Affairs)). Due to the planned low level of CINCPAC activity in PP-79, an abbreviated OAG was formed, consisting of the DCAC, XO, and J2, J3, J4, J5 and J6 action officers. In addition, an officer was assigned to use the MME to parallel and duplicate the duties of the OAG's XO and AXO. This officer was known as the MXO (MME XO).

3. The XO and AXO are the key members in the manual handling of OAG messages. The XO receives all incoming traffic; assigns action or cognizance to the appropriate OAG action officer; keeps the DCAC or COAG informed of significant messages; maintains a Significant Events Log (SEL); ensures that all OAG actions have been properly coordinated; and reviews outgoing messages for proper format, coordination, and content prior to release by the DCAC or COAG. The AXO maintains the master message files, a log of incoming and outgoing messages, and a Status of Action Log (SAL), in which he records pertinent data on OAG actions (who is responsible for the action, suspense date, time of completion, etc).

C. MME Support for the OAG.

1. The MME system was a backup for the manual system for all OAG actions. This was done to ensure that failure of the MME system would not interfere with the timely completion of OAG actions.

2. Only the MXO had a dedicated MME system terminal. The DCAC and other OAG AOs used three additional terminals as required. A fifth terminal was available but was never used.

3. The MXO did not work full time throughout the exercise because the volume of message traffic was low. However, in the MXO's absence, the XO in many cases processed incoming messages on the MME system in addition to his manual message processing, because he had time available.

4. Specific OAG automated message handling procedures.

(a) MXO. All incoming messages on the MME came to the OAG Pending File (OAG MXO). The MXO reviewed each incoming message citation (or message, if necessary). If there were an OAG action required, he assigned the message to the appropriate OAG action officer (AO) and updated the SAL. If the message were a COG item, he forwarded it to the appropriate OAG AO. All incoming messages were filed in the OAG Master file. Important messages were forwarded to the DCAC. The MXO maintained and updated the SEL as required. The MXO reviewed all outgoing messages, ensured all chops had been made, resolved any non-concurrences, and forwarded messages to the DCAC for release. If the outgoing message satisfied a pending OAG action, the MXO updated the SAL. If the outgoing message directed a subordinate to act or requested action from a co-lateral or higher headquarters, the MXO posted the appropriate files. All outgoing OAG messages were filed from the OAG Pending File to one of the three outgoing files. The MXO ensured that all actions generated from non-message sources were entered into the SAL and SEL as appropriate. The MXO readdressed messages as directed by the DCAC.

(b) DCAC. A terminal was available for the DCAC, but was rarely used. Releasing outgoing messages, especially readdressals, was the DCAC's primary use of the system.

(c) Action Officers. The AOs had two terminals available for their exclusive use, in addition to being able to use the DCAC's terminal most of the time. Many AOs made extensive use of the MME system during the time available to them when they were not processing actions using the manual system. The J2 and J4 AOs created extensive files to support the wide variety of messages received during the exercise.

D. User Observations During Exercise Power Play 79.

1. The situation in which the MME system was used for crisis or exercise support during PP-79 was unusual in that the OAG was required to process relatively few outgoing messages (in comparison to the Nifty Nugget exercise conducted in the fall of 1978). Thus there was only a limited opportunity to exercise the message creation, coordination, editing, and release cycle using the MME system.

2. Fifteen OAG users were asked to complete a detailed questionnaire concerning the operational usefulness of the MME system to them during PP-79. The following is a summary of their evaluation.

(a) The users were asked to compare the MME system to the manual system in each of 12 message-handling tasks, using the rating system described in Section II, paragraph B.2.

TASK/CATEGORY	PREFERENCE	USE FACTOR (%)
Reviewing Incoming Messages	40	100
Commenting on Incoming	37	80
Assigning Action	48	53
Passing Messages to Others	58	80
(Incoming Messages)	(47)	
Filing Messages	74	100
Maintaining Files	73	100
Retrieving Messages	84	93
(Filing/Retrieval)	(77)	
Creating Messages	58	93
Replying to Messages	46	67
Coordinating In-Prep Messages	41	73
Editing In-Prep	66	80
Releasing Messages	66	67
(Outgoing Messages)	(55)	

(b) Users were asked to evaluate the responsiveness of the MME system for the same 12 message-handling tasks using the same rating scheme. Again, the difference in the use factor is due to some inconsistent user responses.

TASK/CATEGORY	SATISFACTION	USE FACTOR (%)
Reviewing Incoming Messages	54	93
Commenting on Incoming	54	80
Assigning Action	64	53
Passing Messages to Others	63	67
(Incoming Messages)	(58)	
Filing Messages	77	100
Maintaining Files	70	93
Retrieving Messages	76	100
(Filing/Retrieval)	(75)	
Creating Messages	61	86
Replying to Messages	59	60
Coordinating Messages	55	73
Editing - In-Prep Messages	62	80
Releasing Messages	70	46
(Outgoing Messages)	(61)	

(c) The users evaluated system availability, discounting scheduled downtime, as unsatisfactory, with a score of 45 on a rating scale of 0-100. All fifteen users responded.

(d) In general, the written comments of the users paralleled their evaluation in the numerical portion of the questionnaire. They showed a preference for the manual review of incoming messages, a preference for the MME system's handling of message filing and retrieval, an indifference between the systems for preparation of outgoing messages, dissatisfaction with MME system availability, and reluctance to rely on the MME system as the sole or primary message-handling system.

3. Highlights of MME System Use.

(a) The MME system, when available, was able to process and distribute messages in a timely manner. However, see comments in paragraphs 4(b) and 4(f) below.

(b) The readdressal feature was enthusiastically received by the OAG, AOs and, once demonstrated, was used for almost all message readdressals.

(c) During periods of low OAG activity, some outgoing messages were created and released on the MME system. On one occasion, the CINCPAC SITREP was prepared on various AO terminals, assembled by the MXO on his terminal and released by the DCAC on his terminal.

(d) The ability to retrieve messages from files was the system feature for which the users expressed the highest degree of preference.

4. Problems Encountered.

(a) The major problem with the use of the MME system was the unacceptable amount of unscheduled system downtime. The lack of system reliability mandates a backup or redundant message-message handling system.

(b) Initially a very high load average caused by a software failure resulted in lengthy delays in executing commands. Subsequently, an additional 22% of CPU time was allocated to the OAG user group. This increased processing speed to an acceptable level, but at the expense of the remaining J3 users, who were reduced to 10% in toto. Delays also occurred during the coordination or release process. Once the message left the OAG user job, it lost the advantage of the OAG's CPU slice. On one occasion, it took over an hour for a message to get from one OAG terminal through the processing cycle and arrive at another OAG terminal.

(c) The non-J3 members of the OAG were inexperienced in the use of the MME system and the terminal. Although a training program had been established in January 1979 specifically for non-J3 OAG members, most of the non-J3 members who actually participated in the exercise were not fully qualified on the system. This was overcome by intensive OJT. Within a few sessions the non-J3 OAG members were capable of using the system to display, file, retrieve, create, and comment on messages with minimal assistance.

(d) The precedence of exercise or crisis messages will normally be Immediate or Flash. Currently, the MME system does not distinguish message precedences in assigning processing priority, so that a high precedence message may be delayed in a queue while lower precedence messages are being processed.

(e) The release of OAG-originated and readdressed messages was hampered by previously unknown interface problems between Sigma and the LDMX. A related problem was the lack of notification to the user when a message was rejected by the LDMX.

(f) The MXO, who was fully trained and experienced on the MME system, was totally occupied in trying to accomplish all the tasks he was supposed to perform during the periods he was working on the MME system. At times he was not able to keep up with every task, and had to postpone some, such as maintaining the SAL or other files containing suspense items. The MXO was able to catch up with incoming message distribution in approximately one hour after being absent for an extended period (up to 8-10 hours), due to the low message arrival rate. Since there were relatively few outgoing messages processed on the MME system, the MXO did not spend much time on this facet of message handling. The MXO did spend some time assisting the other OAG users. This would not be required if all OAG members were fully trained. The two MXOs for the exercise agreed that one MXO per 12-hour shift would not have been able to handle all the tasks assigned to the MXO for PP-79 if the incoming message flow had been comparable to that of Exercise Nifty Nugget. For an exercise of that scale it would have taken at least two MXOs per shift to handle all desired functions on the MME system. Although this does not represent any manpower savings over the manual system, the use of the MME system should be of great assistance to the MXOs in several of their message-handling tasks (providing the system's reliability and responsiveness were satisfactory). The MME system's speed and filing system permit much more efficient maintenance of the master message file and log, the SAL, and the SEL.

(g) The ability of an MXO or AO to remain at the terminal and function efficiently for a long shift on a continuing basis during a crisis or exercise is doubtful. After a period of time the ability to concentrate on performing various operations or to look at the screen without its becoming blurred is lost. In PP-79, the message inflow was low enough that the MXO periodically could leave the terminal without falling irretrievably behind. Taking a rest period during Nifty Nugget could easily have resulted in a long, arduous session at the terminal to catch up. It is possible that one of the AOs could spell the MXO from time to time, but during Nifty Nugget most AOs were busy a great part of the time on their own work. Frequent relief for high-use terminal operators definitely must be considered in planning the watch bill for an exercise or crisis.

5. During one portion of the exercise, a record of message arrival times was maintained by the MXO. High precedence messages arrive at the OAG on a line printer directly from the LDMX. Lower precedence messages and back-up copies of high precedence messages arrive at the OAG via pneumatic tube from the CINCPAC Communications Center. The MXO kept a log of incoming message time of receipt (TOR), matching the TOR of the high-precedence messages on the

line printer versus their TOR on the MXO's terminal. Of the 37 messages recorded on the MXO's TOR log, the average TOR on the MME system was 3.4 minutes later than the TOR on the line printer. The TOR on the MME system was consistently well ahead of the arrival of the backup, hard-copy messages received through the pneumatic tube from the Communications Center. The differences varied from a low of two minutes to a high of 29 minutes.

IV. CINCPAC CONCLUSIONS

A. MME Contributions to Efficiency and Manpower Savings. Each of the officers interviewed during the data collection phase of the J3 evaluation was asked to comment on the perceived increase in efficiency of his office's operation due to the use of the MME system and the manpower savings foreseen by use of the MME system in an operational mode.

1. Most of the officers saw no increase in message-handling efficiency as a result of using the MME system. This was primarily due to low system reliability, the ability to process incoming messages faster using the manual system, and an inadequate distribution of terminals.

2. Most of the officers did not feel that use of the MME equipment as an operational system would allow manpower savings in their offices, although the possibility of realizing some savings if the system were to be expanded J3-wide or CINCPAC-wide was recognized. However, these savings might be offset in part by the manpower required to operate and maintain the MME system.

B. Operational Usefulness of an AMHS. The operational usefulness of an AMHS in a major military headquarters has not yet been demonstrated. While the MME system has a number of features that are very beneficial for both daily and crisis or exercise use, it has not been able to perform as a complete system in a way that would permit a definitive evaluation. The following factors have prevented such an evaluation.

1. The reliability of the MME system has not been sufficient to permit it to be used as the primary message-handling system. System downtime and abnormal terminations have plagued the experiment from the beginning. Without a reliable testbed, the users must continue to rely on the manual system for most of their message handling.

2. There is an insufficient number of terminals to support the divisions now participating in the MME. J3 users must compete, in many instances, for the limited number of terminals supporting their branch. This leads to many actions being conducted using the manual system, due to time constraints and other factors, and inhibits the user interface with the system. Not having all of the Operations Directorate or any other CINCPAC directorate on the MME system causes inefficiencies in the message-handling scheme, e.g., outgoing messages must be hand-carried to non-users for coordination. Although the current MME hardware can accept 58 user input-output devices, this would not significantly resolve the terminal problem. The benchmark testing has shown that although the system can handle 20 users, at that point the response time begins to slow markedly. An attempt

to service all 58 terminals could degrade system response time to a level completely unacceptable to the users. The current system architecture is such that it cannot support the number of users needed to demonstrate that an AMHS is operationally useful at CINCPAC for general staff support. It may, however, be sufficient to demonstrate utility for crisis operations if it is used in a major CPX.

3. The man/machine interface became saturated at relatively low message volumes in crisis situations. Extended use of the terminal also causes interface problems. Because opportunity to stress the system in a high message volume situation has not occurred, the ability of the system to support a crisis remains undemonstrated.

V. CINCPAC RECOMMENDATIONS.

A. No AMHS should be developed or fielded without the most intimate participation of the using community. The potential users of an AMHS must be closely involved in the development of system features and operating characteristics. Failure to have the operation of the proposed system rigorously checked in great detail by the prospective users will result in a system that is an inadequate approximation of the one required. The structure of an AMHS must be designed to facilitate incorporation of or deletion of specific operational capabilities without disruption of the overall system model. An AMHS should be given to a user community only after through testing involving selected users. The MME has been a start in the right direction, but user involvement during the experiment should be maintained, day-to-day, during the development of an operational system.

B. J3 users attempted to use the MME system as a substitute for existing manual message-handling procedures. While this approach was mandated by the requirement to keep the manual system operational, in many cases it precluded devising operational procedures which would have better used the characteristics of the automated system. Manual and automated procedures are not interchangeable if either system is to be optimized. Consequently, the design of the AMHS of the future should not be constrained by the using organization's current operating procedures.

C. Reliability is the single, most important design criterion for an AMHS. No system should be fielded until it can demonstrate reliability at least equal to current message processing systems such as the LDMX. Adequate backup systems and procedures must be provided and maintained, not only to ensure that messages can be sent and received, but also to allow access to files and archives.

D. The system must be broadly based. The limited network of terminals available in the J3 Directorate reduced the benefits available from automated message handling. Future systems should provide a dedicated terminal for each management level person, crisis action team member, and administrative person. A terminal density of one per two action officers appears adequate for daily use, but should be tailored to specific user requirements.

E. The system must be responsive. The MME system is too slow, both in executing certain commands and in the scrolling process. Two seconds is a desirable time for the system to respond to a user input. System response is also slowed by procedural requirements for entering commands, confirming commands, checking security, logging on, etc. Additional function keys would alleviate some of the problem if the response time could be minimized.

F. The system must be compatible with other means of message handling.

1. Currently the only method for entering user-originated messages or memos is through the keyboard. Expansion of system input devices to include an Optical Character Reader or a reader of magnetic cards would increase the system's flexibility. Once the message or memo is entered, the action officer can make any editorial changes, using the MME system, with relatively little effort.

2. The system must be compatible with a procedure for handling material that cannot be accomodated on the terminal. Maps, correspondence, items with higher security classifications, and bound documents are examples of material that must sometimes accompany messages and memos through the coordination process.

G. The system must be interoperable with its supporting message transmission system. The problems encountered in the Sigma-LDMX interface have caused a great deal of user dissatisfaction.

H. The current military message standards contained in Joint Army/Navy/Air Force Procedure (JANAP) 128 are not specific enough to allow the most efficient automated processing of military messages. The current standard for the subject line of a message is overly broad, making the creation of an effective algorithm for determining the message subject difficult. In many cases this results in the citation displaying message text in place of the subject. JANAP 128 should be revised to require a more standardized military message format, especially with regard to identification of the subject.

I. Processing priority based on message precedence is required to ensure fast delivery of high precedence messages, both incoming and in-preparation or released.

J. While we have demonstrated that an AMHS can perform certain functions as expected, it is unclear that significant benefits will be realized from the automation process. The perceived lack of increased efficiency of the MME system by the users indicates that a thorough evaluation of any AMHS, of whatever capability, should be conducted. A cost-benefit analysis should be undertaken to compare the costs and benefits of the proposed AMHS with those of the manual message-handling system.

K. None of the desirable features which we recognize in the MME system are of such overriding operational significance that an accelerated effort is necessary to field an AMHS. The development of an optimum operational configuration, as recommended in paragraph A above, should continue to be the result of deliberate, comprehensive, user-oriented efforts.

APPENDIX B. SYSTEM USE DATA

Table 1 gives the total number of users on the system as well as the new users introduced each week from 16 Oct to 7 Apr. It also defines the periods. Table 2 gives the system use by total user hours, total instructions, and instructions per hour. Table 3 shows the total number of user jobs, the number of jobs abnormally terminated, and the corresponding percentage of jobs abnormally terminated. Table 4 gives the total number of messages delivered to MME and the total number of J3 messages identified with J3 as Action or Cognizant addressee. Table 5 gives the number of J3 outgoing messages by day from 22 February to 7 April as a percentage of all on-line traffic. Table 6 provides details on all "Flagged Instructions" occurring during the period of this report. Table 7 provides the system availability for the period covered by the report. Table 8 presents a summary of data describing the use of the MME in Exercise Power Play 79. Tables 9 and 10 present the level of use during the period - table 9 in terms of mean number of user hours per hour and mean number of instructions per hour - table 10 in terms of mean time on-line per day and mean number of instructions per day with the means calculated by type and by user within the type.

Table 1. CHRONOLOGICAL SEQUENCE OF PERIODS FOR THE REPORT ALONG WITH TOTAL NUM OF USERS FOR EACH PERIOD AND NUM OF NEW USERS FOR EACH PERIOD.

PERIOD	DATES ENCOMPASSED	TOTAL NUMBER OF USERS	NEW USERS
1	16 - 18 OCT	14	0
2	19 - 25 OCT	26	0
3	26 OCT - 1 NOV	30	2
4	2 - 8 NOV	29	0
5	9 - 15 NOV	39	5
6	16 - 22 NOV	50	8
7	23 - 29 NOV	50	3
8	30 NOV - 6 DEC	53	2
9	7 - 13 DEC	47	3
10	14 - 20 DEC	41	0
11	21 - 27 DEC	47	6
12	28 DEC - 3 JAN	49	4
13	4 - 10 JAN	62	10
14	11 - 13 JAN	42	4
15	14 - 20 JAN	62	6
16	21 - 27 JAN	67	2
17	28 JAN - 3 FEB	70	5
18	4 - 10 FEB	70	2
19	11 - 17 FEB	66	1
20	18 - 24 FEB (FEU)	57	3
21	25 FEB - 3 MAR	70	0
22	4 - 10 MAR	80	8
23	11 - 17 MAR	89	4
24	18 - 24 MAR	74	0
25	25 - 31 MAR	71	1
26	1 - 7 APR	70	1

Note: Full Experimental Use began in period 20. The exercise was conducted in periods 22-24.

TABLE 2. SYSTEM USE

PERIOD	TOTAL USER HOURS	TOTAL INSTRUCTIONS	INSTRUCTIONS PER HOUR
1	31	350	11.5
2	229	6685	29.2
3	258	5078	19.6
4	383	5576	14.6
5	387	7789	20.1
6	420	10205	24.3
7	450	7889	17.5
8	438	11191	25.6
9	430	10366	24.1
10	277	6707	24.2
11	313	8564	27.4
12	369	8799	23.8
13	451	12911	28.6
14	231	7416	32.1
15	472	13957	29.6
16	557	15270	27.4
17	485	13429	27.7
18	687	15322	22.3
19	336	7429	22.1
20	401	9191	22.9
21	466	10757	23.1
22	906	31841	35.2
23	903	25421	28.2
24	787	19888	25.3
25	854	15316	17.9
26	788	14423	18.3

TABLE 3. USER JOBS

PERIOD	TOTAL NUMBER OF USER JOBS	TOTAL NUMBER OF JOBS ABNORMALLY TERMINATED	PERCENT OF JOBS ABNORMALLY TERMINATED
1	37	11	29.7
2	143	38	26.6
3	134	18	13.4
4	174	24	13.8
5	246	26	10.6
6	373	51	13.7
7	272	32	11.8
8	398	60	15.1
9	273	32	11.7
10	178	45	25.3
11	262	76	29.0
12	258	47	18.2
13	426	119	27.9

PERIOD	TOTAL NUMBER OF USER JOBS	TOTAL NUMBER OF JOBS ABNORMALLY TERMINATED	PERCENT OF JOBS ABNORMALLY TERMINATED
14	246	62	25.2
15	363	101	27.8
16	403	81	20.1
17	373	72	19.3
18	439	73	16.6
19	225	47	20.9
20	239	33	13.8
21	280	55	19.6
22	633	90	14.2
23	655	77	11.8
24	547	97	17.7
25	436	51	11.7
26	404	47	11.6

TABLE 4. SUMMARY OF J3 INCOMING TRAFFIC

PERIOD	TOTAL NUMBER OF MESSAGES DELIVERED TO MME	TOTAL NUMBER OF MESSAGES J3 ACT/COG
1	1331	620
2	3016	1429
3	2981	1327
4	2893	1304
5	2483	1200
6	3066	1595
7	2335	1243
8	3845	1450
9	4678	1368
10	4793	1640
11	3932	1137
12	3442	1024
13	4617	1214
14	2261	570
15	4841	1321
16	4891	1359
17	5053	1533
18	4728	1316
19	5434	1804
20	5271	1556
21	5632	1576
22	7428	3065
23	8039	3602
24	5956	2029
25	5194	1446
26	5457	1509

TABLE 5. SUMMARY OF OUTGOING J3 TRAFFIC FOR 24 FEB - 7 APR (PERIODS 21-26)

DATE/ DAY	TOTAL J3 OUTGOING	TOTAL # RELEASED ON SYSTEM	% OF TOTAL RELEASED ON SYSTEM	READDRESSALS
PERIOD 21 (PLUS 24 FEB)				
FEB				
24	22	2	9.1	1
25	12	0	0	0
26	3	0	0	0
27	8	0	0	0
28	11	0	0	0
MARCH				
1	28	1	3.6	0
2	24	4	16.7	0
3	15	1	6.7	0
TOTAL	123	8	6.5	1
PERIOD 22				
MARCH				
4	3	0	0	0
5	11	1	9.1	0
6	58	24	41.2	21
7	34	8	23.5	4
8	44	15	34.1	15
9	45	10	22.2	4
10	47	9	19.1	5
TOTAL	242	67	27.7	49
PERIOD 23				
MARCH				
11	32	4	12.5	2
12	22	6	27.3	5
13	49	10	20.4	6
14	34	11	32.4	5
15	29	2	6.9	1
16	37	7	18.9	7
17	53	14	26.4	10
TOTAL	222	54	24.3	36

DATE/ DAY	TOTAL J3 OUTGOING	TOTAL # RELEASED ON SYSTEM	% OF TOTAL RELEASED ON SYSTEM	READDRESSALS
PERIOD 24				
MARCH				
18	24	7	29.2	3
19	21	4	19.0	0
20	20	7	35.0	6
21	22	4	18.2	0
22	37	4	12.5	1
23	21	4	19.0	2
24	23	4	17.4	3
TOTAL PERIOD 25	163	34	20.9	15
MARCH				
25	3	0	0	0
26	10	3	30.0	2
27	8	4	50.0	1
28	13	4	30.8	1
29	14	8	57.1	4
30	18	11	61.1	2
31	20	3	15.0	0
TOTAL MARCH	86	33	38.2	10
TOTAL	780	194	24.9	110
PERIOD 26				
APRIL				
1	9	0	0.0	0
2	10	8	80.0	5
3	18	3	16.7	2
4	16	6	37.5	4
5	12	3	25.0	3
6	22	6	27.3	5
7	27	6	22.2	4
TOTAL	114	32	28.1	23

TABLE 6. SUMMARY OF FLAGGED INSTRUCTIONS

INSTRUCTION	% OF TOTAL FLAGS
display message	16
display file	16
view message	7
print	2
view directory	1
find entry	3
clear view window	3
save/update	1
finish	2
file/move	3
delete message	6
restrict/augment	20
backup	0.2
action message	0
forward message	1
route message	1
reply message	0.1
display text	1
comment message	0.4
go to	0.2
coordinate message	2
release message	1
chop message	1
create message	0
create file	0.2
create text	0.01
create selector	1
view selector	0.01
copy/move/pickup/put text	2
keyword message	0
copy entry	1
find string	2
alert	0
readdressal	1
other	3

TABLE 7. SYSTEM AVAILABILITY

PERIOD	PERCENT AVAILABILITY OF THE SYSTEM TO USERS
1	81.3
2	92.4
3	96.7
4	97.3
5	94.3

PERIOD	PERCENT AVAILABILITY OF THE SYSTEM TO USERS
6	89.4
7	93.9
8	90.5
9	94.8
10	55.1
11	88.1
12	78.7
13	81.2
14	86.3
15	87.1
16	89.6
17	82.0
18	90.9
19	49.1
20	54.8
21	66.7
22	90.9
23	87.1
24	88.7
25	93.6
26	78.0

TABLE 8. SYSTEM USE AND DAILY AVAILABILITY (EXERCISE POWER PLAY 79)

DATE	INCOMING TRAFFIC	SYSTEM AVAILABILITY	XO ACTIVITY HRS.	XO ACTIVITY INSTRS.	ALL OTHER PLAYERS ACTIVITY HRS.	ALL OTHER PLAYERS ACTIVITY INSTRS.
MARCH						
6	111	100%	21:30	1331	31:27	2422
7	166	78%	14:26	1031	21:34	1803
8	182	100%	22:00	1224	33:20	2432
9	197	79%	16:30	605	13:38	895
10	197	95%	7:30	699	28:10	2200
11	192	100%	10:00	484	24:19	1350
12	168	72%	7:30	702	22:18	854
13	203	100%	13:00	748	18:17	978
14	246	67%	6:42	406	5:28	356
15	163	100%	19:08	368	12:20	1391
16	137	100%	20:00	870	14:09	778
17	241	68%	16:06	891	5:59	515
18	160	91%	20:00	646	18:26	863
19	124	82%	9:30	815	14:57	1164
20	105	94%	7:44	308	22:56	857
21	110	67%	2:31	63	18:07	330
22	99	89%	2:00	151	17:39	806
23	10	98%			:24	20

TABLE 9 LEVEL OF USE

NOTE: Level of use is noted by period. MUH is the mean number of user hours per hour. M#I is the mean number of instructions per hour.

Level of Use - 10/19 - 11/1 1978

HOUR	MUH	M#I
0000	.61	32.57
0100	.45	15.14
0200	1.13	51.00
0300	1.26	42.15
0400	1.20	32.79
0500	1.05	23.93
0600	0.46	14.36
0700	2.32	57.60
0800	3.65	37.29
0900	3.80	97.64
1000	3.50	93.29
1100	2.27	39.15
1200	1.76	19.50
1300	2.69	50.73
1400	3.00	65.79
1500	2.35	67.11
1600	1.36	25.90
1700	1.14	15.43
1800	.50	9.18
1900	.56	10.60
2000	.70	24.22
2100	.70	73.86
2200	.90	14.32
2300	1.01	14.47

Level of Use - 11/2 - 11/15 1978

HOUR	MUH	M#I
0000	1.39	20.93
0100	1.48	11.36
0200	1.57	17.50
0300	1.62	19.14
0400	1.74	29.50
0500	1.23	31.50
0600	1.04	13.93
0700	3.89	132.50
0800	4.97	125.43
0900	5.20	127.08
1000	4.94	73.64
1100	4.74	59.86
1200	4.15	45.43
1300	4.10	53.86
1400	3.87	77.66
1500	2.99	75.27
1600	1.17	28.34
1700	.81	18.00
1800	.70	27.25
1900	.98	18.75
2000	1.46	15.90
2100	1.37	21.18
2200	1.38	20.08
2300	1.52	17.32

Level of Use - 11/16 - 11/29 1978

HOUR	MUH	M#I
0000	1.27	15.36
0100	1.31	13.93
0200	1.34	19.79
0300	1.35	11.07
0400	1.40	21.28
0500	1.08	16.50
0600	1.27	27.21
0700	4.61	138.86
0800	5.45	152.64
0900	5.35	126.21
1000	5.04	85.57
1100	4.88	74.71
1200	4.79	90.65
1300	4.92	122.57
1400	2.86	83.85
1500	3.00	68.07
1600	1.71	29.72
1700	1.21	27.23
1800	.66	10.24
1900	.86	7.37
2000	.96	14.54
2100	1.08	19.52
2200	1.14	14.07
2300	1.27	16.00

Level of Use - 11/30 - 12/13 1978

HOUR	MUH	M#I
0000	1.26	31.50
0100	1.69	52.50
0200	1.50	22.43
0300	1.61	40.22
0400	1.75	43.72
0500	1.49	27.57
0600	1.48	38.86
0700	5.17	140.21
0800	5.20	136.86
0900	6.54	132.11
1000	5.87	149.50
1100	5.10	90.00
1200	4.43	93.36
1300	4.98	155.64
1400	4.59	135.42
1500	4.93	134.83
1600	2.52	36.17
1700	2.29	37.17
1800	.74	13.50
1900	.83	14.75
2000	1.01	21.50
2100	.88	33.75
2200	1.34	26.25
2300	1.43	27.07

MUH - mean number of user-hours per hour

M#I - mean number of instructions per hour

Level of Use - 12/14 - 12/27 1978

HOUR	MUH	M#I
0000	1.52	42.67
0100	1.24	18.85
0200	1.48	21.27
0300	1.57	31.39
0400	1.64	36.24
0500	1.32	24.67
0600	1.17	33.80
0700	3.70	113.21
0800	4.70	103.27
0900	4.78	116.10
1000	4.47	106.14
1100	4.26	78.11
1200	3.57	78.23
1300	3.60	133.00
1400	2.99	69.10
1500	3.22	61.75
1600	2.07	19.00
1700	1.16	32.42
1800	.93	17.50
1900	.86	20.58
2000	1.15	28.75
2100	1.12	31.38
2200	1.03	21.37
2300	1.29	23.30

Level of Use - 12/28/78 - 1/10/79

HOUR	MUH	M#I
0000	1.39	21.43
0100	1.44	21.07
0200	1.92	23.57
0300	1.74	38.79
0400	1.65	38.57
0500	1.45	32.79
0600	1.70	59.14
0700	4.48	162.00
0800	5.22	161.14
0900	5.59	135.36
1000	6.36	158.00
1100	5.71	122.50
1200	5.15	113.86
1300	5.49	143.29
1400	4.64	134.00
1500	3.67	82.17
1600	2.07	25.33
1700	1.85	26.33
1800	.60	5.80
1900	.98	53.58
2000	.82	48.75
2100	.89	35.82
2200	1.14	32.21
2300	1.35	64.14

MUH - mean number of user-hours per hour

M#I - mean number of instructions per hour

Level of Use - 2/22 - 3/10 1979

HOUR	MUH	M#I
0000	2.99	65.00
0100	2.92	66.40
0200	2.84	88.40
0300	3.27	122.07
0400	3.27	109.53
0500	3.22	118.47
0600	3.91	176.13
0700	7.77	302.13
0800	8.43	231.67
0900	8.55	207.53
1000	8.58	214.29
1100	7.14	158.86
1200	6.41	107.00
1300	7.27	163.08
1400	8.12	163.00
1500	5.49	212.75
1600	4.25	133.08
1700	3.38	95.90
1800	2.23	56.08
1900	3.04	63.64
2000	2.74	98.14
2100	2.77	99.47
2200	2.91	66.13
2300	2.52	78.07

MUH = mean number of user-hours per hour

M#I = mean number of instructions per hour

Level of Use - 3/11 - 3/24 1979

HOUR	MUH	M#I
0000	3.70	82.54
0100	3.98	77.29
0200	4.09	53.21
0300	3.91	55.79
0400	4.07	69.29
0500	3.76	95.29
0600	4.82	174.57
0700	7.67	304.43
0800	8.56	226.14
0900	9.08	211.33
1000	9.02	224.36
1100	8.22	179.50
1200	7.47	126.50
1300	8.05	218.90
1400	8.23	264.36
1500	8.69	245.20
1600	5.24	133.80
1700	4.17	104.00
1800	3.46	93.80
1900	3.69	114.36
2000	3.82	71.36
2100	4.04	101.50
2200	4.05	94.42
2300	3.69	85.69

Level of Use - 3/25 - 4/7 1979

HOUR	MUH	M#I
0000	2.60	34.92
0100	2.78	41.92
0200	2.83	32.75
0300	2.94	30.69
0400	3.32	46.23
0500	3.23	89.30
0600	3.45	151.84
0700	9.08	233.46
0800	10.32	192.54
0900	10.64	204.00
1000	10.70	184.60
1100	9.87	136.76
1200	9.78	85.23
1300	10.66	182.15
1400	11.24	167.09
1500	9.98	184.36
1600	5.09	86.00
1700	2.54	34.40
1800	2.07	26.66
1900	2.38	37.39
2000	2.56	32.80
2100	2.56	49.31
2200	2.53	19.92
2300	2.42	48.62

TABLE 10 'LEVEL OF USE BY USER TYPE

Note: This table presents the average use by users within a particular type (the types are defined in Section 3). The mean time on-line per day is listed for each type of user and for the users within each type. The mean number of instructions per hour is also listed by user-type and by user within type.

LEVEL OF USE BY USER TYPE - 16 Oct - 1 Nov 1978

TYPE	MEAN PER TYPE		MEAN PER USER IN TYPE	
	Time (min.)	# Inst	Time (min.)	# Inst
DBADM	165	18	165	18
J301	149	85	119	68
AO/c.1	268	82	189	58
AO/c.2	169	92	66	36
AO/c.3	132	67	113	58
DBClr	110	17	88	14
CCAIR	495	33	377	25
CCSUR	344	90	206	56
DDO	4	12	4	12
JRC	660	304	373	56

LEVEL OF USE BY TYPE - 2 Nov - 15 Nov 1978

TYPE	MEAN PER TYPE		MEAN PER USER IN TYPE	
	Time (min.)	# Inst	Time (min.)	# Inst
DBADM	546	61	238	27
J301	270	180	202	120
AO/c.1	638	104	355	58
AO/c.2	245	170	60	40
AO/c.3	333	129	141	57
DBClr	199	28	150	22
CCAIR	864	119	546	80
CCSUR	632	175	374	109
DDO	55	14	55	14
JRC	488	107	285	47

LEVEL OF USE BY TYPE - 16 Nov - 29 Nov 1978

TYPE	MEAN PER TYPE		MEAN PER USER IN TYPE	
	Time (min.)	# Inst	Time (min.)	#Inst
DBADM	548	74	214	30
J301	258	210	166	135
AO/c.1	612	81	408	51
AO/c.2	228	227	40	38
AO/c.3	319	168	74	42
DBClr	122	25	76	16
CCAIR	615	46	410	29
CCSUR	541	160	306	95
DDO	73	27	73	27
JRC	594	196	223	84

LEVEL OF USE BY TYPE - 30 Nov - 13 Dec 1978

TYPE	MEAN PER TYPE		MEAN PER USER IN TYPE	
	Time (min.)	# Inst	Time (min.)	# Inst
DBADM	611	108	272	54
J301	278	236	167	142
AO/c.1	396	55	207	28
AO/c.2	253	231	48	49
AO/c.3	132	106	40	32
DBClr	190	48	105	26
CCAIR	571	135	320	76
CCSUR	521	142	261	142
DDO	47	32	47	32
JRC	884	272	387	98

LEVEL OF USE BY TYPE - 14 Dec - 27 Dec 1978

TYPE	MEAN PER TYPE		MEAN PER USER IN TYPE	
	Time (min.)	# Inst	Time (min.)	# Inst
DBADM	520	143	260	71
J301	311	193	173	107
AO/c.1	376	109	150	44
AO/c.2	108	128	36	43
AO/c.3	315	152	76	40
DBClr	242	68	161	45
CCAIR	171	34	133	26
CCSUR	539	109	314	63
DDO	25	45	25	45
JRC	944	355	340	128

LEVEL OF USE BY TYPE - 28 Dec 1978 - 10 Jan 1979

TYPE	MEAN PER TYPE		MEAN PER USER IN TYPE	
	Time (min.)	# Inst	Time (min.)	# Inst
DBADM	677	107	212	33
J301	362	246	155	105
AO/c.1	552	184	199	64
AO/c.2	318	336	49	54
AO/c.3	378	265	86	59
DBClr	351	76	131	31
CCAIR	378	92	189	46
CCSUR	495	67	292	41
DDO	29	33	23	26
JRC	701	206	256	75

LEVEL OF USE BY USER TYPE - 22 Feb - 10 March 1979

TYPE	MEAN PER TYPE		MEAN PER USER IN TYPE	
	Time (min.)	# Inst	Time (min.)	# Inst
DBADM	697	128	246	45
J301	388	244	187	117
AO/c.1	490	117	212	51
AO/c.2	349	310	74	65
AO/c.3	348	183	75	40
DBClr	195	76	74	29
CCAIR	868	252	397	115
CCSUR	590	181	359	110
DDO	376	29	301	23
JRC	870	203	398	93
DBMgt	281	71	121	29
EXERCISE**				
Non-J3	165	226	71	97
AOs	865	939	242	263
CLR	54	84	54	84
SUR	140	88	140	88
MGT	339	102	242	87

** Non-J3 are people who use Sigma for exercise only. Others are users in J3 who were logged on in exercise accounts (J3x, etc.)

LEVEL OF SIGMA USE BY USER TYPE - 11 March - 24 March 1979

TYPE	MEAN PER TYPE		MEAN PER USER IN TYPE	
	Time (min.)	# Inst	Time (min.)	# Inst
DBADM	594	110	148	28
J301	324	187	139	81
AO/c.1	664	145	211	46
AO/c.2	249	302	51	52
AO/c.3	255	157	56	34
DBClr	285	58	95	20
CCAIR	1007	254	455	115
CCSUR	478	167	261	91
CCDDO	104	23	93	20
JRC	1113	227	410	84
DBMgt	727	196	200	54
EXERCISE**				
Non-j3	590	511	114	99
J301	442	48	442	48
AOs	9383	585	250	156
Clr	203	126	203	126
Sur	32	73	32	73

** Non-J3 are people who use Sigma for exercise only. Others are users in J3 who were logged on in exercise accounts (J3x, etc.)

LEVEL OF SIGMA USE BY USER TYPE - 24 March - 7 April 1979

TYPE	MEAN PER TYPE		MEAN PER USER IN TYPE	
	Time (min.)	# Inst	Time (min.)	# Inst
DBADM	1107	194	252	44
J301	585	319	158	85
AO/c.1	808	161	342	68
AO/c.2	655	310	109	52
AO/c.3	655	296	124	56
DBClr	239	69	133	38
CCAIR	1177	328	464	129
CCSUR	744	189	345	88
CCDDO	293	18	183	11
JRC	1415	209	483	71
DBMgt	513	113	138	30